FORBIDDEN KNOWLEDGE

EPISTEME

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OF THE SCIENCES, PURE AND APPLIED

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FORBIDDEN KNOWLEDGE

and Other Essays on the Philosophy of Cognition

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For Kurt Baier
in cordial friendship

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PREFACE

This volume collects together eleven essays in epistemology, written during the past three years. They are mostly unpublished, just four of them having appeared previously (numbers two, three, four and eleven). Detailed acknowledgement of prior publication is made in the notes to the relevant chapters. I am indebted to the editors of the several publications involved for their kind permission to use this material. And I am particularly grateful to my friend, Professor Mario Bunge, for his interest in my work and for his willingness to include this sample of it in his 'Episteme' series.

NICHOLAS RESCHER
Pittsburgh, PA
December, 1986

INTRODUCTION

The philosophy of knowledge covers a vast and enormously diversified terrain. Within this broad area, the essays that comprise the present book deal specifically with the following issues:

1. The moral dimension of inquiry – in particular, scientific inquiry into the ways of the world (Chapter 1)
2. The epistemic status of such cognitive 'values' of inquiry as
   - coherence (Chapter 2)
   - consistency (Chapter 3)
   - completeness (Chapter 4)
3. The cognitive bearing of probabilistic considerations (Chapters 5 and 6)
4. The epistemic status of certain ideal desiderata of cognition, such as
   - totality (Chapter 7)
   - precision (Chapter 8)
   - exactness (Chapter 9)
5. The methodology and the character of specifically *philosophical* inquiry (Chapters 10–11)

The essays try to combine a hard-headed concern for the substance of rigorous inquiry with a traditionally humanistic concern for a value-guided appreciation of its broader implications. Although topically diversified, all of these studies involve the common objective of seeking to illustrate how the aims or goals of inquiry exert an effect on its products.

In an era when fashion leads towards a monolithic 'analysis of knowledge' that regiments this conception into the format of a computational formalism, the book seeks to convey the idea that knowledge is something far more diversified, variegated, and complex than is generally acknowledged.

A volume of essays has a point of advantage over a scholarly book as such – an advantage that can be of use to author and reader alike. Since its substantive unity is less rigid, it can give a somewhat freer play to

ideas, taking a larger and more diversified terrain into view. This facilitates a less didactic, more allusive mode of dialectic that invites the reader to enter into the discussion by making his own connections and drawing his own conclusions. In the present case, these inferential leaps will, it is hoped, move in one particular direction. For a common and unifying pragmatic perspective unites these many-sided deliberations. Our knowledge is a tool or instrument that enables a creature hungry for understanding to get a cognitive grasp on things. And any tool or instrument is bound to reflect in its make-up the uses its user proposes to make of it; it inevitably takes on a form that is coordinated by the ends and purposes for which it is designed. An impetus to idealism thus emerges through the fact that in inquiry as elsewhere process and product are inseparably interconnected.

CHAPTER ONE

FORBIDDEN KNOWLEDGE

Moral Limits of Scientific Research

1. A RANGE OF POSITIONS

One of the very first ideas we meet in the Bible is the teaching of the Book of Genesis which states that there are some things that man has no business knowing about – that the Tree of Knowledge bears some fruit labelled "Hands Off". Perhaps there is a lesson for us in this notion that even our Father and Maker did not see fit to trust us with various sorts of knowledge. After all, knowledge is power, and there are good grounds for thinking that man cannot always be relied upon to use it well.

The present discussion will consider the acquisition, dissemination, and application of knowledge in its specifically *moral* dimension. It explores different aspects of the idea that there might be moral or ethical limits to scientific research – that some sorts of issues are simply "off limits" to morally legitimate inquiry.

Three fundamentally different approaches to the issue of moral limits to scientific investigation are in principle available – along the following lines:

(1) *Panregulation.* A publicly validated "need to know" conditions any and every appropriate inquiry. Knowledge is power and the use of power in a community should *always* be controlled and regulated. Indeed, knowledge belongs to that special ethical category of things which require special treatment and should be controlled with special rigor. And various sorts of knowledge should simply be put "off limits" altogether.

What we have here is, in effect, a totalitarian approach to knowledge – a position reminiscent of George Orwell's *1984* in taking knowledge to be an object of social control, presumably through legal mechanisms of some sort.

This position contrasts diametrically with another, very different view:

(2) *Laissez faire*. It is never appropriate to restrict or regulate knowledge or information. For this is something sacred and sacrosanct. It belongs to that special ethical category of things which, like life or liberty, are the subject of a fundamental and indefeasible right.

On such a view, there must be no restrictions on human inquiry. The knowledge industry should be free from any and all regulation and control. Those who would place constraints on science and inquiry would be seen as bigots and charlatans, fit to be ranged with Lysenko, Goebbels, and the perpetrators of the Inquisition.

Against these two extreme positions which see knowledge as a very special case of all or nothing with regard to morally restrictive fetters, there stands yet another, more relaxed sort of view:

(3) *Middle-of-the-Roadism*. Does not approach knowledge as a special case of some sort. Treat it as simply one good among others – subject to the same general sorts of socially-motivated constraints to which we subject other goods and goals.

On such a view, inquiry and the acquisition of information are seen as human enterprises fundamentally like any other. We regulate, with an eye to the general good, how people can use their cars, practice their professions, operate their business enterprises, or build their houses. So why not how they can manage their inquiries? The acquisition of information is simply one more human project among many others. Its operations can appropriately be subordinated to morally-freighted considerations of the general good. Exactly as with other activities, the public interest is a potential source of appropriate constraints.

These three different approaches compete for our allegiance. They require – and merit – closer examination.

2. REGULATION VS. LAISSEZ FAIRE

Surely, the panregulation view goes too far. Granted that knowledge is power. But in any human community of organization there is a good deal of power wandering about, and there is no good reason why the particular sort of power that is at issue with knowledge should be subject to controls more rigorous or more extensive than any other.

The *laissez faire* view stands at the other extreme. It is nowadays often taken as gospel, widely regarded as one of those virtually self-evident truths that right-minded people have held always and everywhere. We forget how recently this attitude actually evolved, being a child of the eighteenth-century enlightenment, the "age of reason". The great mathematician Maupertuis (an early successor of Leibniz as president of the Royal Academy of Sciences in Berlin) provided a rather drastic expression of this position. He held that it was merely unenlightened folly to let unregarded sentiment stand in the way of progress by not carrying out initial experimentation on prisoners condemned to death. In a paper of 1752 he urged that:

> One should not be deterred by the appearance of cruelty that this sort of thing may conjure up. A single man is as nothing in relation to the entire species, and a criminal miscreant is even less than nothing.[1]

The advancement of knowledge came to be seen as a paramount good that ought to brook no interferences from moral sentiment. To be sure, the enlightenment thinkers, despite their great emphasis on the claims of the *development* of knowledge, did not see the matter of its *diffusion* as something comparably pressing. Even Voltaire and Kant regarded rational inquiry as the business of an elite with which ordinary people have no concern.

All the same, *laissez faire* is also unacceptable. The fact is that we have too great a stake in the conduct of inquiry and in its results simply to let it go its own way without any morally-motivated concern in the matter. As war is too important to be left to generals, so knowledge is too important to be left to scientists and scholars without, at any rate, *moral* checks and balances. *Laissez faire* also goes too far.

Let us therefore consider more closely the merits – and the exact character – of the third, "middle of the road" alternative.

3. MORAL LIMITS PERTAIN TO DIFFERENT ASPECTS OF KNOWLEDGE

It must be stressed from the very outset that moral prohibitions with regard to knowledge can relate to quite different sorts of matters. Three are of particular importance:

(1) Bodies of data: information as such;

(2) Topics of investigation;
(3) Methods or procedures of inquiry.

Let us consider these in turn.

One particularly striking illustration of the idea of morally contaminated data or sources of information is afforded by the experiments carried out in the Nazi death camps. These experiments determined human responses to high/low air pressure and low temperatures. After the war, it became systematic policy on the part of the Western medical community not to make use of this data – a position unquestionably motivated on moral grounds. People just did not want to create a situation where some useful findings might somehow countervail against the negativity of the Nazi horror by having a good emerge from unspeakable evil.

Interestingly, there was a quite different response in relation to the experimentation on toxic chemicals and poison gasses by the Japanese during the World War II years. Their experimental establishment "Unit 731" at Pingfan, near Mukden in Manchuria, carried out research on prisoners of war on the effects of chemical and bacteriological agents used in biochemical warfare. After the war, the US military apparently made a deal with those involved in these operations to trade their findings for immunity from prosecution. A good deal of current information about the effects of these older instruments of chemical and biological warfare apparently is based on these despicable Japanese experiments.

Issues of this sort are bound to engender an ambivalent response. It is clear that much of modern medicine rests on information acquired by very questionable means. (The notorious Tuskegee syphilis experiments are only one instance.) We would clearly be ill-advised to abandon such tainted items of medical knowledge, depriving present and future patients of potentially beneficial treatments out of a misguided puritanism. It is also relevant to turn from the case of morally-contaminated ways of developing information to morally-contaminated sources of support for its development.

The controversy over scholarly and scientific projects sponsored by the Reverend Moon or the late Shah of Iran provide an example. The sorts of arguments used here have a familiar ring by now. The supporters of this argument reason that: "If we are doing something worthwhile, who cares about the paymaster. *Pecunia non olet.* Let the devil

pay for such ventures – no harm done. Better that he use his resources in this way than to perpetrate something wicked." Those against this argument counter: "Do not let the benefit of prestige and legitimacy accrue to a bad cause. Proceeding under aegis or sponsorship of a wicked paymaster is tantamount to collaboration. Don't let an evil individual or institution shine in the reflected glory of a worthy effort." In such cases – as in so many other situations of human life – there are often no easy answers. We must simply do the best we can to balance competing claims.

Let us now turn to the second main sphere of moral sanctions – the idea that there are morally inappropriate *topics* of investigation.

There can be cogent reasons of morality against the development of certain bodies of knowledge. In particular, this would be the case when the knowledge readily lends itself to applications which would impede people's ability to maintain life, liberty, and the pursuit of happiness. The general idea discussed here is that certain sorts of inquiries result in products whose use for evil purposes is so readily possible – and so likely – that it is best not to embark in this direction at all. Whatever benefit for knowledge might result in the way of abstract understanding is overshadowed by the predictable prospect of reprehensible applications.

The dissemination of information on certain issues may also prove to be morally problematic. Consider, for example, the matter of forecasting the end of the world in a few years time due to the impact of a large high-velocity meteorite. Or consider a somewhat more implausible science fiction example: a prediction machine which we could ask about the date of our death or about the duration of our marriage. There is no reason to think that there cannot be facts whose knowledge can injure the interests of people – and that in consequence one could, arguably, be prudentially and morally well-advised to signpost such matters "off limits". Perhaps research into the intellectual or social endowments of particular groups of people, racial or cultural minorities, for example, would also qualify under this category. Or do-it-yourself superbombs. It is just too easy – too tempting – to put such knowledge to bad uses.

Again, there may be some sorts of knowledge that people just cannot handle, destabilizing them to the point where the knowledge destroys or undermines their ability to function effectively. Here it would be imprudent for the individual to acquire this knowledge – and it could be

immoral of another to inflict it upon him. Still, the fact remains that there is nothing improper about such knowledge *per se*, problems arise only when it is put to unintelligent use.

Lastly, there is the idea of morally inappropriate or questionable procedures of inquiry. Plausible examples abound:

- nonconsensual experimentation on human subjects, or even consensual experimentation that inflicts avoidable distress or danger.
- deceit in social science experimentation. Placing experimental subjects unaware into situations that are embarrassing or even degrading for them.
- the inflicting of excessive or avoidable discomfort or distress on laboratory animals.
- experimentation on human genetic materials or on aborted fetuses.
- continuing "control group" placebos after the efficacy of a certain drug or medical procedure is reasonably well-established, simply to embellish the statistical security of one's findings.

Such cases point to a very simple and fundamental fact. Some ways of acquiring information are clearly inappropriate from a moral point of view. (We are no more justified in violating the privacy of our experimental subjects than we are justified in opening the mail of our colleagues – however useful the results may prove to be.) In inquiry, as elsewhere, good ends do not justify evil means. In those cases where an investigation can only be pursued by putting people into dangerous, unpleasant, or ethically unwarrantable conditions, morality urges that we had best leave matters alone. The pursuit of inherently appropriate goals does not atone for immoral behavior. If the only currently available means for investigating a certain issue are morally reprehensible, then moral considerations would indicate that we should turn our attention elsewhere.

Again, the adoption of certain particular procedures or programs of inquiry might conceivably entail risks to the well-being of people that are not worth running. In the early days of the venture there were substantial worries along these lines with respect to recombinant DNA

research. Or consider the peculiar case of the investigation of "Is there intelligent extraterrestrial life?" – a theme made topical by Carl Sagan's recent book, *Contact*. At present, the only feasible way to proceed with inquiry here is by actively endeavoring to establish communication. But this could be extremely dangerous. For contact with "superior" aliens would probably threaten our culture and possibly even our very existence. In such instances we embark on research programmes that run the risk of releasing a deadly genie from nature's bottle. When we are investigating nature in a scientifically serious way it can also happen that – as with a child playing with a chemistry set – it is just too dangerous to proceed in a heedless spirit of "what would happen if we did *X*?"

It is worthwhile, however, to stress the difficulty of applying the principle: avoid developing knowledge that may turn out to have dangerous applications or implications. For it is notoriously difficult to make predictions in the scientific domain.

Commenting shortly after the publication of Frederick Soddy's speculations on atomic bombs in his 1930 book *Science and Life*, Robert A. Millikan, a Nobel laureate in physics, wrote that "the new evidence born of further scientific study is to the effect that it is highly improbable that there is any appreciable amount of available subatomic energy to tap."[2] In science forecasting, the record of even the most qualified practitioners is poor. Above all, it is very hard to foresee what will come out of innovation – particularly predicting the *applications* of scientific and technological innovations. The case of the good Dr. Guillotin – inventor of the guillotine – stands before us as an intimidating example. Wanting to prevent the cruelty of botched beheadings, the well-intentioned doctor devised his convenient and incompetent-proof device. Little did he dream that it was too convenient – and that it would be used during the Terror of the French Revolution in ways – well-intentioned humanitarian that he was – which he would have regarded with righteous horror.

It is thus easy to see why it is that the unfettered pursuit of knowledge can be seen as a potentially bad thing from the moral point of view. The reason is simply the old familiar one of the possibility, and indeed probability, of morally unacceptable consequences. There clearly can – and sometimes doubtless will – be circumstances in which unrestricted inquiry militates against the all-considered best interests of the wider community.

4. CAN KNOWLEDGE AS SUCH BE MORALLY INAPPROPRIATE?

Let us now turn to a somewhat deeper issue. Might there be some items of knowledge that it would just be morally wrong for us to have at all? It is not a matter now of improper acquisition or potential abuse of our knowledge. The question is: Could the mere *possession* of knowledge as such – in and by itself – be morally improper?

We now step beyond the consideration that there may well be some items of information whose possession is *prudentially* inadmissable – knowledge that would be too distressing – too likely to destabilize our psychic equilibrium. Could our relationships with our friends and relations survive a capacity to "read their minds"? Could our ability to function effectively survive a foreknowledge of the hour of our death? Knowledge can be a source not only of information but also of great distress. (Protecting people against an unmasking of their illusions can be an act of paternalistic kindness not dissimilar to protecting someone against knowledge of a long-past and deeply-regretted breach of trust by a close friend.)

It can be argued along such lines that there are *prudential* obstacles to access to certain sorts of information. But what about knowledge which would be *morally* wrong to have at all?

Note to begin with that when the only ways open to us for acquiring certain knowledge are morally inappropriate, then this knowledge becomes something that we certainly ought not to possess – yet only for that very reason, and not because of what is at issue with that knowledge in itself.

Again, some knowledge is such that it virtually invites abuse. Suppose, for example, that Walpole was right and that "Every man has his price". Still, a science that would enable us to measure this price would be deeply problematic. No man is entitled to know the price of another, and few can be trusted with such knowledge. Or suppose that every person has a breaking point beyond which further pressures would cause a loss of self-control. Again, nobody is entitled to this information. A world in which people neither know nor inquire into such matters would be a morally better world – but, of course, this is because this sort of information is too easily misunderstood or abused, and not because there is something morally amiss with knowledge as such. This sort of thing can happen in one's own case as well. Schopenhauer said that the verse of the Lord's Prayer "Lead us not into temptation" really means

"let me not find out the sort of person I really am". No doubt virtually all of us have a temptation threshold – a breaking point beyond which we cannot resist. Its exact placement, however, is clearly an item of information that none of us ought to have at our disposal.

Some information is simply not safe for us – not because there is something wrong with its possession in the abstract, but because it is the sort of thing we humans are not well suited to cope with. There are various things we simply ought not to know. If we did not have to live our lives amidst a fog of uncertainty about a whole range of matters that are actually of fundamental interest and importance to us, it would no longer be a human mode of existence that we would live. Instead, we would become a being of another sort, perhaps angelic, perhaps machine-like, but certainly not human.

There is a more deeply problematic issue, however. Are there also moral limits to the *possession* of information *per se* – are there things that we ought not to know about on moral grounds? Here it is difficult to think of any plausible examples – apart from those that would fall under the scope of the aforementioned cases.

In this respect, it seems that cognitive goods differ fundamentally from material goods. With material goods there are some things whose possession is *ipso facto* morally inappropriate – certain things which people ought not to own at all, independent of how they came by them or how they might go about using them. (The paradigm example is of course other people.) But with cognitive goods this is not so. There seems to be no knowledge whose possession is morally inappropriate *per se*. Here inappropriateness lies only in the mode of acquisition or in the prospect of misuse. With information, possession in and of itself – independently of the matter of its acquisition and utilization – cannot involve moral impropriety.

A related issue crops up. The acceptance of something induces a comparatively greater moral risk, so that we should raise the evidential threshold to a correspondingly elevated level – the same as when accepting something carries a greater practical risk. Even as we ask for weighty evidence before applying desperate remedies, so we ought to impose a high standard of proof before, for example, we proceed to think evil of our fellow man.

And so the question arises: are there some cases where the burden of proof should – on moral grounds – be set so high that *nothing* can reach it? Are there some claims so morally abhorrent that we should refuse to

believe them regardless of the weight of evidence in their favor?

This is a difficult question. But I am inclined to think that an affirmative answer is in order.

Regardless of whether or not there are some propositions which we ought (morally speaking) never even to *entertain*, there are presumably some that we ought (on moral grounds) never to believe – never actually to accept regardless of the weight of evidence we have on their behalf. One plausible example might be as follows. Suppose that, contrary to fact, we humans were mere puppets at the control of a powerful Cartesian demon – that our mental life unfolded in a pre-programmed way, much as the playing of a pre-crafted motion-picture cartoon – so that free will, responsibility, and genuinely autonomous agency were mere illusions. Of course, it would be "morally unfortunate" for this to be so – that is trivally true. But it would be something that is morally problematic for us to accept because it would also destroy our capacity to function as moral agents. (The most fundamental demand of morality is, after all, that we should see ourselves as morally competent agents.)

5. KNOWLEDGE IS ONLY ONE GOOD AMONG OTHERS

At this point we are led back to the beginning of the Garden of Eden story. It is the basically correct moral of this story that we may well have to pay a price for knowledge in terms of moral compromise. Its implicit suggestion that there can be times when it is altogether appropriate to ask whether the moral price of knowledge acquisition may be too great makes perfectly good sense. For it presents us with the useful reminder that we no longer dwell in the Garden of Eden but in an imperfect world where in some instances knowledge may constitute a power with which men cannot invariably be trusted.

One should never lose sight of the fact that knowledge is only one human good among others. Man does not live by knowledge alone; other legitimate and important human enterprises exist and delimit the significance of science within the sphere of our concerns. While knowledge represents an important aspect of the good, it is by no means a sovereignly governing factor that is always and everywhere predominant. It is only one component in a wider framework of human purposes and interests.

In principle and often in practice, free inquiry engenders risks to people – to experimental subjects, to the experimenters themselves, and

to innocent bystanders. And the competing interests must be weighed here – the value of knowledge vs. the welfare of people. (Those who carry on an investigation are not themselves necessarily the best qualified and the best situated to carry out the requisite analysis.) Freedom of inquiry is unquestionably a great good but it is not an absolute one.

6. THE ENFORCEMENT OF MORALS

To deliberate sensibly about what "forbidden knowledge" is, we must recognize that there are very different sorts of prohibitions – different grounds or bases for some things to be "forbidden". Three are particularly important:

Moral: violation of ethical norms;
Prudential: injury to one's interests;
Legal: violation of legal norms as constituted through the political system.

These factors need not by any means agree. For example, morality is not always prudentially advantageous. Quite the reverse – heeding the call of morality often requires us to pay a price in terms of prudential advantage.

Again, things are often morally reprehensible without actually being illegal. Various acts are morally wrong – betraying a trust or a secret, for example – but nevertheless we generally do not (and doubtless should not) want to impose legal sanctions in such matters.

And so, one must not leap to the conclusion that, because somebody says that something is morally wrong, he is necessarily recommending some sort of outright sanction against it. No direct line leads from the contention that there is room for moral approval or condemnation to the idea that one is authorized to call in the "thought police". Even if it is granted that one can identify valid moral limits and restrictions to scientific work, what follows? Actually very little follows straight away. It is necessary once again to draw distinctions. There are many sorts of sanctions against wrongdoing – and many sort of restraints, ranging from personal disapproval through peer pressure to economic and outright legal penalties.

Clearly, it is the moral seriousness of the offense – the extent to which an individual's actions threaten the legitimate interests of others – that must determine the sort of restraint that is appropriate, be it moral

disapproval or something more ominous. Here, as elsewhere, the seriousness of the danger must determine the seriousness of the restraint. Some matters can be left to the conscience of the individual, others to the self-regulation of each professional group. Only with particularly serious issues would one contemplate the imposition of sanctions or penalties beyond the plane of mere moral disapproval.

Moreover, it is clear that moral judgments can be confronted and engaged at very different levels, ranging from the individual to a wider group in which a settled consensus gives expression to *la volonte générale*. Now, supposing that something ethically improper and morally questionable is indeed at issue in a certain inquiry, who bears the responsibility for its avoidance?

There are clearly very different levels at which the actual implementation of ethical limits on scientific inquiry arises.

(1) *The individual*: there will be some things which simply do not square with a person's moral convictions. (e.g., scientists who withdrew from weapons work after Hiroshima.)

(2) *The institution*: even as a maternity hospital can decline to do heart transplants, so a Catholic medical school can appropriately decline to get involved in research on contraceptives when this is perceived as violating the strongly held moral convictions of those involved in funding and operating an institution.

(3) *The profession*: the profession as a whole appropriately can and should establish certain professional codes.

(4) *The social/national group*: scientific research inevitably proceeds within a social/public framework that imposes constraints both on what to fund and what to license (e.g., cosmetics research that sacrifices experimental animals). Expressions of the political will of the community are at issue here.

Even if it was granted that there are, or should be, moral or ethical limits on the development and use of scientific information, the question of the level (if any) at which these limits should be *implemented* arises as a further and by no means straightforward issue. When the stronger modes of sanctions are at issue (via allocations or legal restrictions), it is clear that only "society" can legitimately decide (via the political process) between the right of some to pursue free inquiry and the right of

others for safety and the protection of their legitimate interests. (That, after all, is one of the prime functions of a political system – to adjudicate between competing claims.)

Here we come to the other lesson of the Genesis story. Expelled from the Garden of Eden, we humans have to cope on our own in a complex and difficult world which confronts us with problems that can be both unexpected and unwelcome. The political process by which we make the collective decisions by which we manage our communal affairs is no doubt gravely imperfect and deeply flawed – even at its democratic best. But it is all that we have.

The pursuit, acquisition, and dissemination of knowledge is only one particular human endeavor. It is a process made possible and maintained through human and financial resources committed by a society that, in the final analysis, has the right and even the duty to control it in the best interests of all who have a stake in the matter.

We have entered here into an area of deliberation where there are no easy answers. Three basic principles deserve to be borne in mind.

(1) Inquiry is a human activity. It must, in the final analysis, be subject to the same general standards of moral appraisal that we use in relation to any other human activity.

(2) All the same, our great stake in knowledge must be recognized. It is primarily by knowledge that we have made our evolutionary way in the world, and it is to knowledge that we must look for a solution to many or most problems that we face in the world today. Only grave reasons – only clear and present dangers – can ever underwrite a legitimate abridgement of the claims of free inquiry.

(3) We live in a "grey" world of few blacks and whites. And so we must make compromises – settle for the lesser of evils, balancing the claims of free inquiry against other important and valid human interests.

Substantial though the claims of unfettered inquiry are, there is, in principle, no reason why its needs should *always* prevail. A good case can be made out for saying that sometimes when it is too unsettling, and often when it is too easily abused, man simply cannot be entrusted with certain sorts of knowledge. The risks posed by the availability of certain sorts of knowledge are so great that other goods outweight the negativities of its avoidance.

We standardly balance advantages against risks in rational decision-making, and there is no good reason why this standard approach should be suspended in the contexts of making decisions about the conduct of inquiry and the development of information. At many junctures of life we face a situation of conflict where we must balance goods, claims and rights against each other. No Moses has come down from the mountain with tablets graven on high to the effect that the quest for knowledge is an overriding priority – that freedom to investigate and to inquire, to disseminate and to teach automatically outweighs any other human interest with which it can come into conflict.

At this point the issue of "academic freedom" arises. For someone is bound to come along and say: "One cannot put *any* sort of limits – be they legal or administrative or moral – on scientific work without doing violence to academic freedom".

There are good grounds for such a protest. Academic freedom, as traditionally conceived, has two components – freedom to teach (*Lehrfreiheit*) and freedom to inquire, to do research (*Forschungsfreiheit*). Clearly, the placement of any limitations on the acquisition or diffusion of scientific information is bound to impede one or the other of these modes of freedom.

Yet these freedoms, legitimate and important though they are, are not absolute and indefeasible. In everyday life we constantly limit people's rights and claims in protecting the interests of others – in furtherance of the common good. However important it may be, and however weighty its claims, knowledge is not something sacrosanct – something that must *automatically* prevail in the tug of war of competing human interests. The rational defense of even legitimate values cannot descend to fanaticism. Academic freedom is not an absolute. Here, as elsewhere, the freedom of some can and should be circumscribed by the rights of others.

One fundamental issue in the morality of inquiry pivots on the question: who is being put at risk in the conduct of a scientific inquiry? Is it to be

- the scientific workers themselves;
- their experimental subjects;
- some particular group of concerned individuals;
- the community at large?

The question of "Who bears the risks?" is a crucial one here. Clearly, it is morally right and proper that those who are being put at risk should

have a say in the matter. From the ethical point of view, the risks inherent in scientific inquiry are the same as the risks created through any other human activity. Those involved have the right to be informed and to be consulted, and involved in decision-making.

The freedom of inquirers must be co-ordinated with the legitimate interests of others – pre-eminently including those of the general community at large. The claims of knowledge have to be balanced against other claims. Even as in the investment of our economic resources we have to recognize that the cognitive enterprise is only one among others, so in the investment of moral concern we must acknowledge this same fundamental point. The authority and the claims of science are great and profoundly legitimate – but not absolute. Like all authority and all claims, they have their limits.

7. CODA

This discussion has been concerned to stress that there ought to be – and *are* – moral limits to scientific research. But in closing, it seems appropriate to strike a somewhat different note.

While the cultivation of knowledge is indeed only one worthy human project among many, it is nevertheless a *particularly* important one. Man's great stake in understanding must be stressed. *Homo sapiens* is a rational animal. The life of the mind is special. Knowledge is something special. Our interest in it goes as deep as life itself. When we are cognitively disoriented – when we do not know our way about – we can hardly function effectively. We cannot operate in this world without adequate cognitive accommodation to it. Our mind needs information every bit as much as our body needs food.

For knowledge plays a very special role in human affairs. In particular, whatever other projects we may have in view – justice, health, environmental attractiveness, the cultivation of human relations, and so on – it is pretty much inevitable that their realization will be facilitated by the knowledge of relevant facts. Thus, even though the pursuit of knowledge is not our only appropriate task, it is nevertheless an enterprise whose normative standing is high because knowledge serves to facilitate the realization of any other legitimate good: any and every such good is cultivated the more effectively by someone who pursues its realization knowledgeably.

To be sure, the *laissez faire* approach sketched at the outset of this essay is ultimately unacceptable. But it does carry an important grain of

truth because there is a very powerful presumption in favor of *laissez faire*. The claims of unfettered inquiry are substantial. They are sufficiently weighty and sufficiently valid that they should never be set aside for anything short of a clear and present danger.

It is for this reason that the idea of "moral limits" should always be implemented with care. Free inquiry is a delicate and vulnerable plant we would do well to nurture and protect as much as we can. One should never interfere with it lightly lest one do fatal injury to a human resource of inestimable value.

The upshot, then, is that there *are* moral limits to inquiry and we *can* legitimately implement them in some cases. But we are well advised to do so only when other vital interests are seriously put at risk. The idea of "forbidden knowledge" is one we should never apply lightly – through to say this is not quite to say that it should never be applied at all.[3]

CHAPTER TWO

TRUTH AS IDEAL COHERENCE

1. THE "CONTINUITY CONDITION" RELATING A CRITERION TO THE DEFINITION OF TRUTH

The usual objection to the coherence theory of factual truth is that the linkage of coherence to truth is simply too loose for coherence to provide the definitive standard of truth. As Arthur Pap put it some years ago:

> It is quite conceivable that the coherence theory is a description of how the truth or falsehood of statements comes to be known rather than an analysis of the meaning of "true". . . . One might agree that a given statement is accepted as true in virtue of standing in certain logical relations to other statements; still it would not follow that in calling it true one *means* to ascribe to it those relations.[1]

Here we have the standard reservation regarding a coherence theory of truth: "It may be suited as a *criterion* for the true, but certainly not as a *definitional standard* of truth." The aim of the present deliberations is to show that this line of objection is untenable.

Our theme, then, is the much-debated question of whether the bearing of coherence is limited to its potential role as a mere *criterion of factual truth*, or whether coherence somehow inheres in the definition of truth by reflecting an *essential aspect of its nature*.[2] It will be shown here that if one is prepared to consider coherence in an *idealized* perspective – as *optimal* coherence with a *perfected* data base, rather than as a matter of apparent coherence with the imperfect data we actually have in hand – then an essential link between truth and coherence emerges.[3]

Supporters of a coherentist standard of truth must be able to establish that this criterion is duly consonant with the definitional nature of truth, for there ought rightfully to be a *continuity* of operation between our evidential criterion of acceptability-as-true and the "truth" as definitionally specified. Any satisfactory criterion must be such as to yield the real thing – at any rate in sufficiently favorable circumstances. Fortunately for coherentism, it is possible to demonstrate rigorously that truth is tantamount to ideal coherence – that a proposition's being true is in fact *equivalent* to its being optimally coherent with an ideal data base.

We shall refer to this requirement that true theses are coextensive with criteriologically justified beliefs *in ideal circumstances* as "the continuity condition". A bit of symbolism will be helpful in providing a precise formulation to this condition:

> $C(S/f)$ is to stand for: the statement S satisfies the truth-criterion C given that circumstances f obtain;
>
> $i(S)$ is to stand for: (epistemically) ideal circumstances with respect to the statement S.

Given these specifications, the continuity condition now reads as follows:

> If C is to constitute an adequate criterion of truth, then it must be demonstrably the case that for any statement S, the truth of S is tantamount to its satisfying C under ideal evidential conditions with respect to S:
>
> 'S' is true iff $C(S/i(S))$

It is the demand for this sort of deep-rooted relationship which is at issue in Brand Blanshard's right-minded insistence that "a 'logical gap' so broad that a criterion and what it is supposed to indicate may each be present in the absence of the other surely falls short of the trustworthiness required of a criterion".[4]

Accordingly, to validate a coherent criteriology we must be able to show that, at least ideally, if we abstract from the imperfections of messy real-life situations, coherence does indeed get at "the real truth of things". This, then is the thesis we have to demonstrate.

One preliminary point. If C is to serve as our criterion of truth, then we shall have it that C-satisfaction in the prevailing epistemic circumstances suffices to underwrite acceptance as true:

> If $C(S/a)$, where a represents the *actually* prevailing circumstances, then 'S' is true.

Commitment to this implication follows at once from our adoption of C as a criterion *of truth*. But this condition, of course, only reflects a *practical policy* of ours, inherent in subscribing to C as a criterion of truth: it merely expresses our determination to accept 'S' as true when C is actually satisfied. What is at issue here is not an abstract general principle, but only our adherence to a certain *modus operandi*. And

there is, of course, the prospect of a slip between cup and lip here, since the actual circumstances, a, may be far from ideal for S. That "practical policy" at issue comes down to the rough and ready posture that the prevailing circumstances are good enough – that the "data on hand" are sufficient to permit us to decide the matter. On the other hand, the continuity criterion – 'S' is true if and only if $C(S/i(S))$ – represents a relationship that must be satisfied *as a matter of conceptual fact*. It must obtain demonstrably on the basis of "general principles" if the truth-condition C is to qualify as adequate.

2. TRUTH AS IDEAL COHERENCE

Let us say that a factual proposition satisfies the condition of "ideal coherence" if it is *optimally* coherent with a *perfected* (or completed) data base. Given the nature of "coherence", such a proposition will fit more smoothly and consistently with this idealized data base than does its negation (and so consequently fits better than any other proposition that is incompatible with it). The ensuing discussion will argue that, *when ideal coherence is construed in this way, then truth is demonstrably tantamount to ideal coherence*. It will endeavor to demonstrate that the linkage between these two factors becomes an essential one.

To establish this contention, it must be shown that two implication theses obtain with respect to any and all statements:

(I) true $\rightarrow$ ideally coherent.
(II) ideally coherent $\rightarrow$ true.

The idea of "ideal coherence" operative here should be understood as being a matter of *optimal coherence* (c) with a *perfected data base* (B). Deploying these abbreviations, it is clear that the two principles at issue can now be formulated as follows:

(I) 'S' is true $\rightarrow$ 'S' c B.
(II) 'S' c $B \rightarrow$ 'S' is true.

Note that when the specific coherentist truth criterion stands in place of our earlier generic C, we have, by hypothesis, that 'S' c B is tantamount to $C(S/i(S))$. Accordingly, the two principles now at issue simply restate the continuity condition in the special case of a coherence criteriology of truth.

If the coherence theory is to be adequate, the validation of these two

principles will thus have to be grounded in the very nature of "optimal coherence (c) with a perfected data base (B)". To establish them we shall need to look more closely at the crucial ideas at issue: the conceptions of "optimal coherence" and of a "perfected data base."

First a word about *optimal* coherence. Just what is it "to cohere optimally with a data base"? What does 'S' c B involve? The answer is provided by two conditions:

(1) 'S' represents a member of some family of mutually exclusive and exhaustive alternatives: $\{S_1, S_2, S_3 \ldots, S_n,\}$

(2) 'S' is more smoothly co-systematizable with B in this case than is any of its alternatives, singly or in combination. (Note that this means specifically that 'S' is more smoothly co-systematizable with B than is 'not-S'.)

To implement this second idea, we must have in hand some definite family of concrete principles of cognitive systematization which determines a standard of systemic connection according to which 'S' is more smoothly coordinated with B than is the case with any (combination) of its available alternatives. However, since here is not the place for a full-scale presentation of a coherentist truth-criteriology, this is something which we need not discuss in further detail within the orbit of present purposes.[5]

Let us now turn to the idea of a "perfected data base". Perfection has two components: *completeness* (or comprehensiveness) and *adequacy* (or definitiveness). These have the following ramifications:

(1) *Completeness*: If D is to be a *perfected* data base, then it must be sufficiently complete and comprehensive that, for any thesis 'S' within the domain of discussion at issue, either 'S' itself or its negation 'not-S' will cohere optimally with D:

> If perf (D), then: either 'S' c D or 'not-S' c D, for any and every statement 'S' of the relevant domain.

(2) *Adequacy*: To acknowledge D as a *perfected* data base is to acknowledge it as actuality-determinative. And so we must endorse:

> If perf (D), then: if 'S' c D, then $A(S)$.

Completeness requires *decisiveness*; adequacy requires *facticity*. These

are conditions that inhere in the very notion of the "perfection" of a data base.

To be sure, all this is not to say that we can ever actually *find* such a perfected data base. We doubtless cannot. The very idea of such a data base represents an idealization. The claim at issue is framed in a strictly hypothetical mode: "If a perfected data base exists, then it must *ipso facto* have certain characteristics". We are, in effect, dealing with the *meaning postulates* or definitional requirements for the idea of a "perfected data base" – certain explanatory stipulations for what the ideal of such a data base involves (in the context of "optimal coherence").

As a preliminary consideration, let us first establish the effective *uniqueness* of such a perfected data base in point of optimal coherence. To demonstrate this, let us make the assumption that both B_1 and B_2 answer to the characterization of a "perfected data base". We can then establish:

> If 'S' c B_1, then 'S' c B_2, for any statement 'S'.

This is accomplished by the following argument:

(1) Suppose: 'S' c B_1
(2) Suppose further that not: 'S' c B_2
(3) Then 'not-S' c B_2 follows from (2) by *Completeness*
(4) Then A (not-S) follows from (3) by *Adequacy*
(5) But $A(S)$ follows from (1) by *Adequacy*
(6) Since (4) and (5) are mutually contradictory given the Law of the Exluded Middle, we must negate supposition (2), and hence have: 'S' c B_2. QED

The converse, of course, follows by exactly the same line of reasoning. And this shows that with respect to "optimal coherence" there is in effect (at most) one perfected data base. Let us continue to designate this by B. By definition, then, B is the (unique) perfected data base – whose availability, as already observed, we can claim not as a matter of realizable fact but only as a matter of idealization.

It follows immediately from the two stipulated requirements of Completeness and Adequacy that B must satisfy the conditions represented by the following principles:

> (P1) By the condition of Adequacy we have it that if 'S' does indeed optimally cohere with B, then this state of affairs must be actual:

'S' c $B \rightarrow A(S)$.

(P2) By the condition of Completeness we have it that if 'S' does not cohere optimally with the perfected data base (B), then it follows that 'not-S' will be optimally coherent with the perfected data base B. Symbolically:

('S' c B) $\rightarrow$ ('not-S' c B).

These two principles, (P1) and (P2), will furnish the materials on whose basis our two focal implication theses (I) and (II) can and must be established. They are all we have; if the job is to be done, they must suffice to do it.

Before proceeding to show this, however, the idea of "actuality" reflected in our "$A(S)$" deserves some comment. The claim at issue is one of factuality, of "adequation to fact" (*adaequatio ad rem*): to assert "$A(S)$" is to maintain that the state of affairs S is a constituent of the real world, that existing reality is (in part) characterized by this state of affairs. (Thus to assert "$A(S)$" is effectively to assert that 'S' represents a "*bestehender Sachverhalt*", an *actual state of affairs*, in the vocabulary of Ludwig Wittgenstein's *Tractatus Logico-Philosophicus*.) The thesis at issue with "$A(S)$" is an *ontological* one: it claims that that is how things in fact are, whether or not people know or believe it. And this ontologically definitive aspect of A means that we must have the "law of the excluded middle" represented by a *tertium non datur* principle:

(LEM) $-A(S)$ iff A (not-S)

Actuality must "make up its mind" with respect to the $A(S)$ vs. A(not-S) dichotomy. This condition inheres axiomatically in the very meaning of "actuality".

On this basis, let us now proceed to establish principles (I) and (II) as stated on p. 19. The required demonstration is easily produced.

Given that truth is (by definition, as it were) subject to the ancient principle of accord with fact (*adaequatio ad rem*):

(A) 'S' is true $\longleftrightarrow A(S)$

we have it that principle (P1) immediately entails:

'S' c $B \rightarrow$ 'S' is true

This provides for thesis II, so that half of our task is already accomplished.

To obtain thesis I, let us consider principle (P1) in the special case of the state of affairs 'not-*S*':

(1) $-A(\text{not-}S) \rightarrow -(\text{'not-}S\text{' c } B)$

By the Law of Excluded Middle, namely:

(LEM) $A(S) \longleftrightarrow -A(\text{not-}S)$

we have it that (1) yields:

(2) $A(\text{S}) \rightarrow -(\text{'not-}S\text{' c } B)$

Now in view of (P2), this yields:

$$A(S) \rightarrow \text{'}S\text{' c } B$$

And given (A), this in turn yields:

$$\text{'}S\text{' is true} \rightarrow \text{'}S\text{' c } B$$

We have thus also provided for thesis (I), thereby completing our task.

It follows from the resultant equivalence of truth-as-adequation on the one side with ideal coherence on the other that an adequationist view of the nature of truth affords no insuperable obstacles to coherentism. The co-ordinative linkage between truth and (idealized) coherence is grounded in the fundamental general principles of the matter, and the coherentist standard thus meets the crucial continuity condition that is an adequacy requirement for any viable criterion of truth. The continuity condition is satisfied. As regards its theoretical eligibility, we may inscribe *nihil obstat* on the proposal to construe truth in terms of idealized coherence.

3. COHERENTISM AND TRUTH AS ADEQUATION

It remains to be shown, however, that the "ancient principle of accord with fact, of *adaequatio ad rem*" – namely, thesis (A) above – is also available to the coherentist who, after all, does not propose to *define* truth in this way, so that it is not to him a mere truism (as it is to the adequationist). Accordingly, we must show that this thesis is derivable on coherentist principles, given that these principles consist not of (P1) and (P2) alone, but also the favored truth-determinative axiom (or definition) that is obtained when we conjoin theses I and II:

(C) $\text{'}S\text{' is true} \longleftrightarrow \text{'}S\text{' c } B.$

Note that in view of this axiom, we have it that (P1) yields

$$\text{'}S\text{' is true} \rightarrow A(S).$$

To obtain the converse, consider the principle (P1) in the special case of the state of affairs 'not-*S*':

$$-A(\text{not-}S) \rightarrow -(\text{'not-}S\text{' c } B).$$

By the Law of Excluded Middle (LEM) this will entail:

$$A(S) \rightarrow -(\text{'not-}S\text{' c } B).$$

By (P2) this yields:

$$A(S) \rightarrow \text{'}S\text{' c } B.$$

By (C) this yields:

$$A(S) \rightarrow \text{'}S\text{' is true.}$$

Together with its converse, as derived above, this provides for (A). QED

It follows that an equating of "the (real) truth" with adequation to fact (with how matters actually stand in the world) is also an implicit consequence – *in the idealized case* – of a coherentist conception of the nature of truth. The coherentist accordingly has no need to renounce adequation. If he defines truth in terms of ideal coherence, the principle of adequation (A) remains available to the coherentist as reflecting an essential feature of truth. This circumstance that principle (A) characterizes the essence of truth is as available to him as to anyone else.

Let us recall that principle (A) encapsulates the *correspondentist* view of the nature of truth as adequation to fact:

(A) $\text{'}S\text{' is true} \longleftrightarrow A(S).$

On the other hand, principle (C) encapsulates the *coherentist* view of the nature of truth as ideal coherence:

(C) $\text{'}S\text{' is true} \longleftrightarrow \text{'}S\text{' c } B.$

Note now that the second section of this essay has established:

$$\{(\text{LEM}), (\text{P1}), (\text{P2}), (\text{A})\} \text{ entails } (\text{C}).$$

And the argumentation of the present section has established:

$$\{(\text{LEM}), (\text{P1}), (\text{P2}), (\text{C})\} \text{ entails } (\text{A}).$$

Putting these together, we arrive at:

$$\{(\text{LEM}), (\text{P1}), (\text{P2})\} \text{ entails } [(\text{A}) \longleftrightarrow (\text{C})].$$

Given the explication of "ideal coherence" at issue in the principles (P1) and (P2) (or, equivalently, in the conditions of *Completeness* and *Adequacy*), it emerges that adequationism and coherentism are effectively co-ordinated. The coherentist criteriology of truth is also available to the adequationist. The adequationist view of the nature of truth is also available to the coherentist. The two positions can (under plausible suppositions) be co-ordinated with one another as flatly equivalent.

The pivotal problem of this essay's first section is thus resolved. The present deliberations indicate that the coherentist criterion of truth as optimal systematization is qualified to serve as a truth-criterion in virtue of satisfying the continuity condition. Authentic truth may be characterized essentialistically in terms of *idealized* coherence; putative truth may be identified criteriologically in terms of *manifest* coherence. And continuity is thereby assured.

This is all to the good. Brand Blanshard's insistence on the continuity condition is very much in order. He urges, in effect, that "If you are seriously proposing to adopt coherence with 'the data' as a criterial standard of truth, then you should be able to show this proposal to be warranted through some sort of essential linkage between truth and coherence." As he puts it:

> If we accept coherence as our test, we must use it everywhere. We must therefore use it to test the suggestion that truth is other than coherence. But if we do, we shall find that we must reject the suggestion as leading to incoherence.[6]

And this point is well taken. A definition or interpretation of truth that did not meet this condition would thereby manifest its own inadequacy.

In showing that the coherentist criterion of truth is capable of meeting the continuity condition, the present deliberations manage to set aside one of the main traditional reservations about the acceptability of coherentism.

4. POSTSCRIPT: THE GAP BETWEEN THE REAL AND THE IDEAL

To be sure, an important issue remains open. Given that "the real truth" is guaranteed only by *ideal* coherence – by optimal coherence

with a perfected data base that we do not have, rather than by *apparent* coherence with the suboptimal data base we actually have in hand – we have no categorical assurance of the actual correctness of our coherence-guided inquiries. Nor do we have an unqualified guarantee that their deliverances provide "the real truth" that we seek in matters of empirical inquiry. Quite the reverse. The history of science shows that our "discoveries" about how things work in the world secured through scientific coherentism constantly require adjustment, correction, replacement. We cannot say that our coherence-grounded scientific theorizing provides us with the real (definitive) truth, but just that it provides us with *the best estimate* of the truth that we can achieve in the circumstances at hand.

An important point in epistemology thus lies at the core of our deliberations. The essential linkage between truth and rational justification is not definitional (we do not have it that: truth = justified belief). Nor again is this linkage an empirical matter of an observed statistical correlation: "our justified beliefs are true most of the time" – a law which, in the case of science at any rate, is falsified rather than confirmed by the course of experience. Rather, the linkage between truth and rational justification is secured in the conceptual order, albeit only at the level of ideas: truth is rationally justified belief *in ideal cases*.

Definitive knowledge – as opposed to "merely putative" knowledge – is the fruit of *perfected* inquiry. Only here, at the idealized level of perfected science, could we count on securing the real truth about the world that "corresponds to reality" as the traditional phrase has it. Factual knowledge at the level of generality and precision at issue in scientific theorizing is akin to a *perfect* circle. Try as we will, we cannot quite succeed in producing it. We do our best and call the result knowledge – even as we call that carefully drawn "circle" on the blackboard a *circle*. But we do realize that what we currently call scientific knowledge is no more authentic (perfected) knowledge than what we call a circle in a geometry diagram is an authentic (perfected) circle. Our "knowledge" is in such cases no more than our *best estimate* of the truth of things. Lacking the advantage of a God's-eye view, we have no access to the world's facts save through the mediation of (potentially flawed) *inquiry*. All we can do – and what must suffice us because indeed it is *all* that we can do – is to do the best we can with the cognitive state of the art to *estimate* "the correct" answers to our scientific questions.

In the subideal, real-life conditions of an epistemically difficult world, an evidential gap indeed separates *presumptive* from *certifiable* truth. But given an adequate criteriology of truth, this gap becomes closed in ideal circumstances. The continuity condition reflects the fact that inquiry aims at truth – that the real truth is the definitive aim and aspiration of the scientific enterprise.

The circumstance that what we achieve in our practice of scientific coherentism is not the real truth as such, but only our best estimate, reflects the fact that we must pursue this cognitive enterprise amid the harsh realities and complexities of an imperfect world. In deliberating about the truth of our scientific claims, as elsewhere, the gap between the real and the ideal must be acknowledged.[7]

CHAPTER THREE

RATIONALITY AND CONSISTENCY

1. CONSISTENCY: INITIAL REQUISITE OR ULTIMATE IDEAL?

Is consistency indispensable? Is the avoidance of self-contradiction indeed the fundamental requisite and decisive touchstone of rationality?

It will be maintained here that the answer is negative – that consistency, like certainty and completeness, while indeed a cognitive desideratum at the *ideal* level, nevertheless is not a fundamental precondition that is indispensably necessary in our actually prevailing circumstances. Consistency should accordingly be seen as an ultimate ideal rather than as a fundamental prerequisite for rationality. It is a good, but not a necessity.

2. LINEARLY INFERENTIAL VS. DIALECTICALLY CYCLIC REASONING

Much, if not most, of our thinking is carried out under conditions where we do *not* deem the premisses from which we reason to be absolutely certain truths, but merely very probable or plausible suppositions. This situation has far-reaching implications for the appropriate character and structure of our reasoning, implications which are generally unheeded and unrecognized.

Whenever we reason in a deductively valid way from assured premisses – premisses viewed as being true in line with the traditional conception of "truth" as systematized in classical logic – we automatically know (a) that our conclusions are themselves certain and thus one and all unproblematically acceptable. Moreover, we also know (b) that they are mutually consistent – compatible not only with the totality of our initial premisses but also with each other. Accordingly, our reasoning can be linear and progressive. We can march straight on, never needing to look back over our shoulders at earlier findings to assure ourselves that the new ones have not rendered the old unacceptable, or that prior results are reconcilable with the new ones. We can constantly

forge ahead into new territory, confident that there is no point in looking backwards to reexamine old positions in the light of new ones.

By contrast, "dialectical" reasoning is a matter of the repeated reconsideration of old issues from newly attained points of view. The root idea of such reasoning is that of a multistage process where we repeatedly re-examine one self-same issue from different, and mutually inconsistent, points of view. It is a matter of developing a course of reasoning in several phases or "moments" where we consider an issue from different and mutually incompatible points of departure, moving in a roundabout way from a thesis via another not altogether compatible with it to a conclusion of some sort. We proceed in circles or cycles where we return to a certain issue first in this light and then in that. We do not constantly press onwards to new ground, we repeatedly criss-cross the same terrain, approaching the old issues from different and often discordant angles. We have a plurality of witnesses, for example, who assert conflicting claims with respect to an historical episode. And we give each of them a favorable, sympathetic hearing – tentatively accepting the assertions of each "to give them a run for their money." Thus by examining the entire situation sequentially in the light of different "versions", we try to distill out a plausible overall account that may – even in the end – leave various issues unresolved and unreconciled.

This cyclical aspect, with its reconsideration of the same issues from various perspectives of consideration, is the feature which, above all, sets "dialectical" thinking apart from the standard case of linearly inferential reasoning. In this way, there is a sequential deepening of the case for the conclusions one is endeavoring to substantiate. One "tightens the net", so to speak, though the sequential development of an increasingly adequate case, consolidating the issue now in this aspect and now in that, returning to the same issue from different angles, making use of varying and even mutually inconsistent premisses for its substantiation. When we are doing history, for example, this is exactly the sort of thing we have to do.

In dialectical reasoning we make assertions that are negated ("corrected") by subsequent counter-assertions. We have here a process of successive approximation, where at each stage we assert things that are literally false and in need of eventual correction. When things go smoothly, however, these successive corrections appertain to increasingly minor and insignificant issues. We begin by saying what is

correct "in the first analysis" – the first rough approximation. And then we negate this by a suitable qualifying "correction", and so on. What we say at each stage is not literally correct but only correct up to a point. There is need for continued qualification, as per the sequence:

- P obtains always;
- But when Q, P never obtains;
- Still when both Q and R, P always obtains;
- But when Q and R and S, P never obtains.

Though what we say is literally false at each stage, nevertheless (a) if the course of reasoning is well managed, then the incorrectness becomes one of the increasingly minor significance, and (b) what ultimately emerges is that the initial thesis is "roughly" of "approximately" true in the sense of involving only minor and manageable provisoes.

To be sure, this sort of thing is dispensable and pointless in the case of strictly *deductive* reasoning. For whenever one can deductively establish that q given p and *also* establish that q given not $-p$, then one can establish q absolutely via the constructive dilemma:

(1) $p \rightarrow q$
(2) $-p \rightarrow q$
(3) $-p \vee -p$

$\therefore q$

While such a course of reasoning does indeed reflect the quintessentially dialectical move to a conclusion (q) via contradictory premisses (p and not-p, respectively), still, in the specifically deductive case, this process is quite unnecessary and altogether avoidable. For if one can demonstrate q via *this* particular route, one can always establish it without any reference to p. In such a case, the particular p at issue actually does no work for us at all. Seeing that $X \rightarrow q$ must hold good, we could have obtained q from any arbitrary premisses at all. (We accordingly have no need for "dialectical reasoning" in mathematico-deductive contexts, where deductively cogent reasoning from categorically accepted premisses is the order of the day.)

With probable and plausible reasoning, however, the situation is very different. Let us first consider the situation of plausible reasoning. Here we begin with a collection of premisses or data that afford promising

prospects – not validated certainties but tempting theses that have some substantial claim to our acceptance, but are by no means certain. Here we not only have no preassured guarantee that the data are actually true, we even lack the assurance that they are mutually compatible. (Actual truths, of course, must be compatible, but mere plausibilities need not be.) Even if we were to confine ourselves to strictly deductive inference, we have no assurance that what we attain is true – we know at best that it is itself something plausible.

Yet even here we may be able to learn something, and to derive some useful information. Consider a schematic example. Let it be that we are given as plausible data the three following mutually incompatible propositions:

$$p \rightarrow q,\ p\ \&\ (q \rightarrow \mathrm{r})\ \&\ s,\ (\neg q\ \&\ s).$$

These three premisses are clearly inconsistent – the last two entail $p\ \&\ \neg q$ which contradicts the first. The status of s is interesting however. For no matter how we proceed in investigating the matter – whichever (maximal) consistent subset of those plausible premisses we might adopt as a basis for reasoning – s will emerge unscathed. And this systemic fact that we have a suitable family of substantially different arguments for s is crucial. We do not establish s deductively by proceeding on a one-shot basis to reason from any or all of this data. We establish it dialectically by showing that no matter how we proceed from the different consistency-restoring curtailments of our inconsistent data, s is still something that we can secure. Those different arguments for s are only seemingly redundant; in the overall probative situation, they are all needed. We do not actually secure s until we have worked our way through the whole series of arguments.[1]

As this illustration indicates, there is a vast difference between the case of reasoning from premisses pre-established as certain (as certainly true), and that of reasoning from premisses whose acceptability is based on a footing of mere plausability (as plausibly or presumably true). In this sort of circumstance, it can make eminent sense to proceed sequentially, returning to the same contention from different angles of consideration.

Let us now turn from plausibilities to probabilities. It deserves note that a perfectly valid course of reasoning is at issue in a "probability dilemma" of the following form:

(1) q is (conditionally) probable given p
(2) q is (conditionally) probable given not–p

$\therefore$ q is probable (period).

For premiss (1) is tantamount to:

$$pr(q/p) = \frac{pr(q \,\&\, p)}{pr(p)} > 1/2 \text{ or } 2pr(q \,\&\, p) > pr(p).$$

And premiss (2) is tantamount to:

$$pr(q/-p) = \frac{pr(q \,\&\, -p)}{pr(-p)} > 1/2 \text{ or } 2\, pr(q \,\&\, -p) > pr(-p).$$

Combining these we obtain:

$$2[pr(q \,\&\, p) + pr(q \,\&\, -p)] > pr(p) + pr(-p).$$

Whence

$$pr(q) > 1/2.$$

And observe that it would have made no difference if we had set the operative probability threshold for counting as "probably true" at 3/4 or at 99/100 instead of 1/2. The upshot that "q is probably true" would have been the same.

Note, however, that in this probabilistic case the particular p we make use of in probability-conditionalization is something that does real work for us – contrary to the deductive case. (The mere fact that q is probable *per se* does *not* mean that it is probable relative to any and every sort of condition p whatsoever.) The probable mediating thesis p plays a probative role here akin to that of the middle term in Aristotelian syllogistics. The task of finding a suitable link is a matter of cleverness and ingenuity which, if unresolved, prevents this whole line of reasoning from getting off to a start.

There is an important lesson here. In situations when the cognitive ground beneath our feet is not totally firm – where our deliberations are relatively speculative – it may make perfectly good sense to proceed dialectically and consider an issue prismatically in the variable light of not merely different but even inconsistent perspectives. It is possible to envision situations in which as good a case can be made for inconsistent claims as for almost anything else that one accepts. We are well advised to steel ourselves to tolerate occasional inconsistencies. There is nothing irrational about this.

3. AMPLIATIVE VS. REDUCTIVE REASONING

There are two profoundly different approaches to the cognitive enterprise which, for want of better choices, might be called the *ampliative* and the *reductive*, respectively.

The ampliative strategy searches for highly secure propositions that are acceptable as "true beyond reasonable doubt". Given such a carefully circumscribed and tightly controlled starter-set of propositions, one proceeds to move outwards ampliatively by making inferences from this secure starter set. The resulting picture is illustrated by Figure 1.

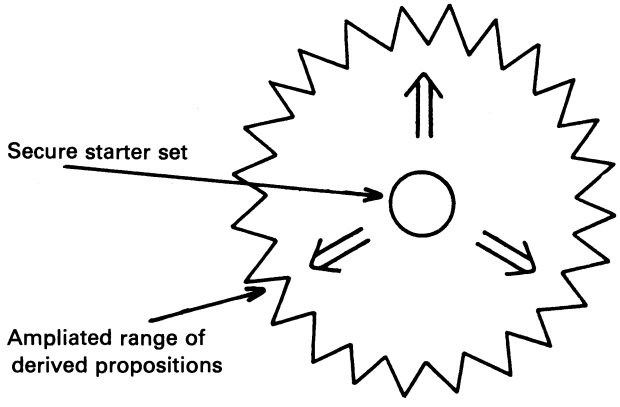

Fig. 1. The Ampliative Approach.

Here we proceed expansively, by moving outward from the secure home base of an entirely unproblematic core.

The reductive strategy, however, proceeds in exactly the opposite direction. It begins in a quest not for unproblematically acceptable truths, but for well-qualified candidates or prospects for truth. At the outset one does not require contentions that are certain and altogether qualified for recognition as genuine truths, but proposition that are no more than plausible, well spoken-for, well-grounded candidates for endorsement. Of course, not all of these promising truth-candidates are endorsed or accepted as true. We cannot simply adopt the whole lot, because they are competing – mutually contradictory. What we have to do is to impose a delimiting (and consistency-restoring) screening-out that separates the sheep from the goats until we are left with something

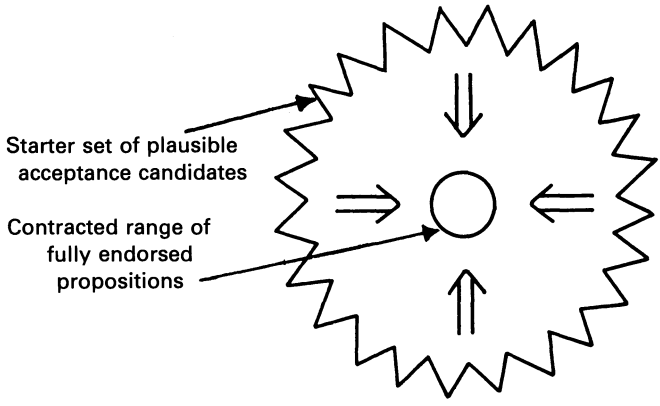

Fig. 2. The Reductive Approach.

that merits endorsement. And here we proceed by way of diminution or compression as per Figure 2, which makes it clear that the reductive approach proceeds by *narrowing* that over-ample range of plausible prospects for endorsement.

While the paradigm instrument of ampliative reasoning is *deductive* derivation, the paradigm method of contraction is dialectical argumentation. To effect the necessary reductions we do not proceed via a single deductive chain, but through backing and filling along complex cycles which criss-cross over the same ground from different angles of approach in their efforts to identify weak spots. The object of the exercise is to determine how well enmeshed a thesis is in the complex fabric of diverse and potentially discordant and competing contentions. We are now looking for the best candidates among competing alternatives – for that resolution for which, on balance, the strongest overall case can be made out. It is not "the uniquely correct answer" but "the most defensible position" that we seek in dialetics.

4. TWO VERY DIFFERENT SORTS OF ACCEPTABILITY: QUALIFIED VS. OUTRIGHT BELIEF

The epistemology of a reductively developed cognitive discipline is thus something radically different from that of an ampliatively developed one. With ampliative reasoning we proceed "foundationally" in the manner of an axiomatic approach. The first and paramount task is to

obtain that "starter set" – that firm basis of secure, certain, and unquestionably acceptable propositions from which the rest of the system can be ampliated. We embark on a quest reminiscent of Descartes for clear and distinct certainties on whose basis we can erect a larger cognitive structure. Security, certainty, unproblematic acceptability become our touchstones.

With reductive reasoning, however, the matter stands on a very different footing. The touchstone is now not certainty, but something on the order of plausibility, or credibility, or likelihood, or verisimilitude. Here we want to cast our net widely to gather in as much as we can of all those contentions that "have something to be said" for them. We are not searching for cognitive "solid citizens" alone, but are involved in gathering in as many "plausible prospects" as we can get hold of. Our view of "acceptability" changes from acceptable-as-certain to acceptable-as-a-credible-prospect – from outright endorsement to serious entertainment.

Very different sorts of cognitive acceptability are accordingly at issue: acceptability as certain (C-acceptability) in contrast with acceptability as credible, as plausible and promising (P-acceptability). The former is a matter of unqualified endorsement, the latter of tentative or provisional endorsement. Accepting something as a certain fact is something very different from accepting it as a promising prospect.

Consider the situation depicted in Table I. Clearly, this situation

TABLE I
A paradox of rational belief

(1)	One believes it to be the case that p.
(2)	One is a rational agent.
(3)	Rational agents act on their beliefs.
(4)	One will act (in any and all circumstances) on one's belief that p. (From (1)–(3)).
(5)	One recognizes (concedes, allows) that there is some small chance that p might be false.
(6)	One is offered a bet that will pay one cent if p is true and invoke an awful catastrophe (say the end of organic life in the universe) if not-p is true.
(7)	One would bet on p in this case. (From (4), (6)).
(8)	Rational agents are (somewhat) Bayesian. They guide their actions by the balance of risk and return. And so they do not accept minute inducements to run even small risks of (sufficiently great) disasters.
(9)	One would bet on not-p in this case (From (5), (6), (8)).

confronts us with an outright contradiction. Something must give way. But what? Since (1) and (2) and (6) are merely hypotheses here, they stand secure. Four alternatives are thus open:

- One can abandon (3).
- One can abandon (8).
- One can abandon (5) as untenable in the presence of (1) and (2).

None of these options is attractive. We do not want to abandon (3) and dissociate belief from action in the context of rationality. Again, we do not want to abandon (8). We are rightly reluctant to forego the Bayesian approach to rational decision making. Nor is it all that easy to abandon (5). For it is not an appealing prospect to hold that rational believers cannot concede some prospect or possibility that their beliefs might be false – i.e., that they are constrained to see all their beliefs as absolutely and definitively certain. How can we exit from difficulty?

As is so often the case with such theoretical difficulties, the way out lies through the door of a distinction. Our beliefs are not all of a piece. There are two possibilities as regards their epistemic status. There are things we believe-to-be-absolutely-certain (C-beliefs). We view these as *totally* secure and *utterly* safe. We would bet literally *everything* on them. With respect to these beliefs – but only these – the inference from (1)–(3) to (4) holds good.

Such wholly unconditional beliefs, of course, are few and far between. The rational man uses due epistemic caution. Most of what we believe we believe-to-be-plausible (P-beliefs). We view these as adequately secure and relatively safe – but not as altogether certain. They are secured against all *realistic* possibilities that something might go wrong, but not against all *conceivable* possibilities. For these P-beliefs we would not put "everything" at risk.

On the basis of this distinction, then, we are able to avert the paradox of Table I. The reading of "belief" in (1) that authorizes the move to (4) via (3) presumes that we are dealing with C-beliefs. But the reading of "belief" in (1) that allows us to invoke (5) is predicated on its being P-beliefs that are at issue. The distinction between C-beliefs and P-beliefs averts the paradox at issue. It enables us to effect a reduction of that over-rich family of (inconsistent) initial commitments. (Note that this very methodology itself exhibits the reductive approach.)

And this distinction is in itself a perfectly rational one. We are prepared to chisel some of our beliefs in stone. Others we readily admit to be written in sand. Some things we accept in a dogmatic frame of mind, while others we accept only guardedly.

What is at issue with regards to this distinction between *C*- and *P*-beliefs is not, of course, a difference in *content* of beliefs. The difference is one of *status*. At first I accept something on the basis of surmise and conjecture; eventually I come into possession of strongly confirming evidence. It is not the contention at issue that changes, but the light in which I view it.

Some contentions (viz., those represented by C-beliefs) I accept absolutely, others I accept all right (and, of course, accept as true – because that is what "acceptance" is) but in a less committed, more tentative frame of mind. When I set down my contentions, I write the former in red with the latter in black. Regardless of what color ink I use, when I make the statement, I use it to say the same thing – it makes exactly the same claim. The different is only in respect to my *confidence* in this claim.[2]

5. DIFFERENT ATTITUDES TOWARDS CONSISTENCY

Such a duality of stances towards "acceptability" carries a very different attitude towards consistency in its wake. If we want a secure starter set, an absolutely solid foundation for an ampliative process of inference, then consistency is everything. But if we want a wide canvass of plausible prospects – of potentially competing alternatives that gather in the promising possibilities over a wide range to set the stage for a reductive process, then inconsistencies will not worry us very much. Now, after all, our concern is not with *certainty* and confident acceptance but with *provisional credibility* and tentative acceptance.

The implementation of an ampliative epistemology calls for a keen eye to basic certainties. The quest for that appropriate starter set of secure axiomatic propositions is the paramount task. A reductive epistemology calls for a mind-set oriented to breadth in the first instance rather than depth. It is a matter of a wide-ranging search for plausibilities rather than a deep-probing reach for fundamentalities. The model is that of a detective searching for plausible clues and indications rather than that of a mathematician searching for assured axioms. The process of disputation and controversy affords a good illustration of the sort of

thing that is at issue. Argument in a controversial discussion, rather than mathematical demonstration along Euclidean lines, is the best model for dialectics. Not only do the two different approaches – the inferential/ampliative and the dialectical/reductive – call for very different views of acceptability, they invoke very different views of consistency as well. With inferential/ampliative reasoning, consistency is everything. When our starter set of initially accepted premisses is not consistent, we can reach no viable conclusions. When our conclusions are inconsistent, we are in an untenable position. With dialectical/reductive reasoning, the case is very different.

Suppose, for example, we are given as basic data a trio of initially acceptable ("plausible") propositions that form an inconsistent triad: (P, Q, R). Under the pressure of the ideal of consistency, we are impelled to "compress" (i.e. curtail or reduce) this inconsistent set to a consistent one. This, of course, can always be done in different ways:

TABLE II

	Retain	Reject
Alternative 1	P, Q	R
Alternative 2	P, R	Q
Alternative 3	Q, R	P

The "pressure" of consistency-restoration can always, in principle, lead to different expulsions from our inconsistent data.

What we need to do in order to effect a reasoned choice among these alternatives is to establish some *priority or precedence* among the data: to implement the idea that while they are all "acceptable" in a credibility-oriented sense, some are more acceptable than others – that in situations of potential conflict some have lesser claims on us for retention than others. And this matter of priority ranking will in its turn admit of alternatives, or differences in *context* – in perspective or point of view. In the context C_1 of one domain of inquiry, P may have the lowest priority, but in context C_2, it may be Q.

It should be emphasized that such an approach to the handling of inconsistencies is not a matter of willfulness, of doing as we please at the

moment, of an "anything goes" incoherence. The variation of outcome is not a matter of subjective preference – of "what I happen to want at the time", but of something that is (or can be) perfectly objective – viz. "contextual appropriateness" with respect to a particular area of investigation. Not "what I happen to want at the time", but what is appropriate to the particular domain of deliberation at hand is the determining factor. The question pivots on the objective issue of what *deserves* to be given precedence and priority in a certain context of inquiry, in view of the prevailing principles of this domain. (The difficulty is that the way in which it works itself out is not something absolute and context-invariant, but something variable and context-relative. We enter the sphere of contextual relativity.)

The validation of such a prospect hinges on the availability of appropriate "resolution criteria" to force a consistent result from an inconsistent set of initial data, which are themselves not context-invariant but situation-variable and context-sensitive. Of course, we shall always strive for consistency *locally* – in any *particular* area of inquiry – under the aegis of locally applicable resolution criteria. Still we can – and should – recognize that there may not, nay sometimes will not, be any such criteria that are globally invariant across the whole spectrum of our investigative concerns.

But how can "the *rational* person" ever accept inconsistency? Why should we be inconsistency tolerant? What sort of considerations can reconcile the rational inquirer to accepting inconsistency?

The reply must run roughly as follows. People have questions and want to obtain answers to them. These answers are only available through certain standards of acceptability. These, however, always admit some "noise" into the system – some degree of entropy and imperfection. And this allows for a certain amount of misinformation and disinformation along with the information. Thus we are put into the position of having to pay a price for the relief of ignorance – by accepting a situation where the avoidance of "errors of omission" carries the prospect of "errors of commission" in its wake. In these circumstances, the price of inconsistency avoidance in terms of information loss can become simply too large for comfort. The trade-off between sporadic (localizable) inconsistencies and information forfeits is so balanced that we are "rationally well advised" to take (occasional and localizable) inconsistencies in our stride.[3]

6. THE PLACE OF DIALECTICS IN THE HUMAN SCIENCES

Reviewers, critics, and commentators often reproach an author with inconsistency for reasoning on one particular page from some contention P and on another page from some other contention that is incompatible with P. But such a condemnation may well be superficial and unthinking. For outside the domain of mathematical reasoning, this "prismatic" approach of looking at an issue from different angles – proceeding dialectically to consider it now in the light of Q and again in the light of not-Q – can be a perfectly sensible and altogether useful way of proceeding. Let us examine – and substantiate – this significant state of affairs.

Reasoning can proceed not just inferentially (ampliatively) but also dialectically (reductively). What is at issue is not a difference in the rigor – let alone the rationality – of one's reasoning, but rather a difference in the style of the reasoning.

There are two different sorts of cognitive disciplines – the hard (e.g. physics), for which the mathematical/ampliative model is doubtless optimal, and the soft (e.g. history), for which the dialectical/reductive model is optimal.

Human thought is inherently complex and many-sided, a matter of inner tensions, of competing pushes and pulls in varying directions. In biographical interpretation, in the description and explanation of historical *transactions*, in the interpretation of literary or artistic creations – throughout the humanities, in short – this prismatic complexity comes to the fore.

In the natural sciences, cognitive systematization almost always conforms to the ampliative paradigm. We begin with a relatively modest starter-set of observational results, well-confirmed through repeatable experiments and explanatory theories, well-established in contexts of prediction and application. And we then proceed outwards by the deductively inferential means of mathematical derivation. The expansive model standardly prevails. In the humanities, however, the situation is generally very different. Paradiagmatically (in historiography, for example) one proceeds not inferentially but dialectically. One gathers in all the promising "data" and prunes them into a coherent structure. The contractive model comes into prominence.

Both processes aim at the same end result, insofar as both are ventures in "the quest for Truth". But they proceed in this common

quest in very different ways – ways that, though very different in certain fundamental respects, are alike in their common allegiance to rigorous rationality. The salient difference is not between quantitative sciences and non-quantitative disciplines, but between those areas where one's reasoning is deductively inferential and those where we must proceed by dialectical means. The processes of inferential and dialectical reasoning, however different in other ways, are not different in that one is a matter of rigorous thinking and the other of irresponsible sloppiness – that one is "genuinely scientific" and the other "mere basket-weaving". The widespread tendency to think of the "human sciences" (the historical and humanistic disciplines) as non-scientific is based on an overly narrow and narrow-minded conception of rigorous reasoning.

7. MUST INCONSISTENCY-TOLERANCE BE MOTIVATED EPISTEMICALLY?

To this point, our discussion motivated the potential acceptability of incompatible theses in essentially epistemic terms through the distinction between acceptability-as-true and acceptability-as-credible. In this *epistemological* perspective, the inconsistency of "accepted data" is seen as the product of a flaw in our mechanisms of data-generation, and the reductive process as a matter of the search for truth. A very different *ontological* perspective is also possible, however. Reality can be regarded as a complex manifold that is by nature inconsistent – a superposition of incompatible conditions.[4] The quest for consistency is merely a matter of practical human convenience – a response to the demands of a limited creature with an intolerance of cognitive dissonance and an incapacity to accept inconsistency. Accordingly, while reality is (within limits) inconsistent, we observers see it as generally consistent because we can only observationally process one alternative at a time. But such a reduction of ontologically co-equal incompossibilities to a single definite outcome is always a matter of an observational impoverishment that does not accurately reflect the complex nature of alternative-combining reality.

The tables have now been turned on the perspective of the preceding deliberations. There, reality was viewed as a consistent whole, and inconsistency was taken to result from informational overdetermination. Now, however, reality itself, ontologically speaking, is a superposition of inconsistent states of affairs, and our epistemic resources are

unable to process this condition adequately and so oversimplify the complex realities to yield one single consistent result.

This more radical prospect suggests that the epistemically motivated inconsistency tolerance of the preceding discussion is in fact a comparatively conservative position.

8. CONSISTENCY AS A COGNITIVE IDEAL

Aristotle's influence has much to answer for – his own explicit disavowal of the quest for unwarranted rigor notwithstanding. By his insistence that deductively articulated science alone is genuinely scientific and that dialectics is a matter of "mere rhetoric", he set back for some 2,000 years the development of rational dialectics (and the dialectical disciplines themselves). Even now, some two milennia later, we are far from freeing ourselves from his prejudice that only ampliative/deductive reasoning is genuinely cogent and that reductive/dialectical reasoning is something inferior and second rate. We are still caught up in the backwash of the Greek beliefs that only those disciplines whose rational systematization proceeds by way of mathematico-linear development are rigorous and solid, and that those disciplines that proceed by way of dialectically cyclic argumentation are somehow inferior and unsatisfactory.

Surely a more liberal and open-minded attitude is in order. In those cases where the linear approach can be implemented effectively, well and good. But there is nothing to apologize for in those cases where a more complex and "messy" dialectical approach to cognitive systematization is needed to accomplish the work in hand.

The root idea of rationality is that of cost-benefit coordination – of seeking for the best means to valid ends. The cognitive enterprise falls within this framework just as much as any other. Consistency is no be-all and end-all, and its maintenance is not indispensably necessary. Since the principal aim is knowledge as such, it is only realistic to reconcile ourselves to the fact that we may be called upon to tolerate occasional singularities of inconsistency in the interests of achieving the best overall balance of information over ignorance and misinformation.

Cognitive rationality as such does not involve an absolute, unswerving commitment to consistency at any cost. Consistency is a prime *desideratum* of rationality, but not an absolutely indispensable *requisite* for it. It should be valued not as a present demand, but as an ultimate

ideal. A preparedness to tolerate conflict and messiness – nay even inconsistency – is often in the interest of doing as well as we can manage to at this stage of the game. There is little to be said for an impatient insistence on securing here and now all across the board that order and orderliness which is available only in the domain of the dead, the cut-and-dry regions of museums, encyclopedias, and graveyards.

In abstract contexts (e.g. mathematics) where the formal demands of logic are paramount, inconsistency is a disaster, a fatal flaw. In the less stylized setting of informal dialectics, however, the situation is very different. Here the reality of rational dialectic is such that charges of inconsistency are always ultimately fruitless. A sufficiently clever interlocutor will always find – or devise – distinctions that will remove outright inconsistency. Inconsistency – that gravest of logical faults – is, in general, always venial in informal contexts; for it can be removed with a number of "corrections" by introducing requisite distinctions. The crucial issue is always an ultimately evaluative one – whether those complicating epicycles are ultimately acceptable.

Contrary to widespread opinion, one need *not* take the stance that consistency is an inevitable precondition for cogent thought and rationally acceptable reflection. Consistency may reasonably be regarded as a feature that is essential only in limited areas of formalizable deliberation (mathematics, pure and applied), but need not characterize rational cognition in general. The maintenance of consistency may be regarded as essentially akin to the achievement of completeness, uniformity, or truth – as something to be cultivated and prized. It must obviously and unquestionably count as an epistemic desideratum – a regulative idea or *telos* for dealing with the murky complexity of the concrete cases with which we generally have to work. But it need certainly not be seen as an absolute requisite for rationality – something in whose absence the whole enterprise comes to utter grief.

CHAPTER FOUR

AN END TO SCIENCE?

1. IS SCIENTIFIC DISCOVERY AN INHERENTLY BOUNDED VENTURE?

Fundamental science makes substantial demands on the public purse nowadays – as is illustrated in recent press discussions about the multi-billion dollar supercollider. Are these great investments worthwhile in terms of intellectual payoff? Or is the wellspring of new discovery about to run dry? Some years ago, Bentley Glass made newspaper headlines with his presidential address to the American Association for the Advancement of Science, posing the question "Are there finite limits to scientific understanding, or are there endless horizons?"[1] His answer ran as follows:

> What remains to be learned may indeed dwarf imagination. Nevertheless, the universe itself is closed and finite. . . . The uniformity of nature and the general applicability of natural laws set limits to knowledge. If there are just 100, or 105, or 110 ways in which atoms may form, then when one has identified the full range of properties of these, singly and in combination, chemical knowledge will be complete. There is a finite number of species of plants and animals – even of insects – upon the earth. . . . Moreover, the universality of the genetic code, the common character of proteins in different species, the generality of cellular structure and cellular reproduction, the basic similarity of energy metabolism in all species and of photosynthesis in green plants and bacteria, and the universal evolution of living forms through mutation and natural selection all lead inescapably to a conclusion that, although diversity may be great, the laws of life, based on similarities, are finite in number and comprehensible to us in the main even now. We are like the explorers of a great continent who have penetrated to its margins in most points of the compass and have mapped the major mountain chains and rivers. There are still innumerable details to fill in, but the endless horizons no longer exist.[2]

This perspective sees the scientific project as an inherently bounded venture, subject to the idea that in scientific inquiry, as in the geographical exploration of the planet, we are ultimately bound to reach the end of the road.[3]

Insofar as a well-defined course of reasoning underlies this exploration analogy it is essentially the argument sketched out in Table I, an argument that moves from the finitude of nature herself to that of natural science as we know it.

TABLE I
The 'END-TO-SCIENCE' argument

(1)	The cardinal aim of science is to produce an inventory (that is, a *complete* inventory) of the laws of nature.
(2)	The laws of nature are generalizations that specify how the constituents of nature interact.
(3)	Nature has only a finite number of constituents.
(4)	*Therefore*, there are only finitely many laws of nature.
(5)	*Therefore*, science is a finite project that has a natural end.

It is the aim of this discussion to set out some general theoretical reasons why this idea of an inevitable ending to scientific inquiry is deeply problematic. Its thesis is that the prospect of an approaching end to science is highly unrealistic.

2. NATURE MIGHT EXHIBIT AN UNENDING COMPLEXITY OF PHYSICAL CONSTITUTION

To underwrite the prospect of endless progress in the development of natural science, some theoreticians deem it necessary to stipulate an intrinsic infinitude in the makeup of nature as a physical structure.[4] The physicist David Bohm, for example, writes: "at least as a working hypothesis science assumes the infinity of nature; and this assumption fits the facts much better than any other point of view that we know."[5] And in line with this approach, he postulates a principle of unending complexity in nature's makeup.

Such an infinity-of-nature postulate may take various forms. One of them involves the suggestion that the domain of natural laws is inexhaustible, following the lines of Pascal's idea that nature might be an endless nest of Chinese boxes, with microscopic worlds emplaced within ever more minute microcosms.[6] It contemplates a system of wheels within wheels – somewhat on analogy with the idea that every organism comes equipped with a yet smaller organism to bite it. Sometimes this shrinkage toward the submicroscopically small is inverted into an expanding sequence moving unendingly upward toward the supratelescopically large – emplacing macroscopic worlds within ever more macroscopic ones. (Perhaps what we see as a galaxy is simply a subatomic particle of a macroworld, and our whole universe no more than an atom.) Following this line of thought, one might project an ascending sequence: subatomic particles, atoms, molecules, organic microorganisms, animals,

populations, life-systems, solar systems, galaxies, galactic clusters, worlds, world-systems, and so on, each furnished with its own characteristic modes of operation. Every system is potentially a member of a larger system. On either view – with ongoing increase or decrease alike – the prospect of a theoretically unending progress of science is assured by the existence of an unending series of new worlds embracing (or embraced by) the old.[7] Science is potentially unending because there are ever new orders of nature to be explored.

Some theorists take a less radical course and exchange the appeal to continuing levels of *physical* inclusiveness for an ever-deepening succession of operating principles or "forces" within the physical makeup of nature. As one physicist puts it:

> Why should nature run on just a finite number of different types of force? May there not be an infinite hierarchy of types of force just as there is an infinity of structures that may be built up of matter interacting under the influence of one or more of those forces? . . . It is perfectly possible that there exist objects that interact powerfully with each other but only exceedingly feebly with the objects with which we are familiar, that is to say with objects that interact strongly with ourselves, so that these unknown objects could build up complex structures that could share our natural world but of which we should be ignorant.[8]

Theorists of this persuasion envision an endless succession of natural forces, each operating in its own parametric sphere within an unendingly varied cosmic manifold.

Such an unfolding complexity in the physical constitution of nature would serve to assure that, in principle, the well of potential scientific discovery need never run dry. It clearly suffices for this end. But it is by no means necessary – which is fortunate, since such infinity-of-nature postulates invariably have a far fetched air about them. To see that they are not needed to provide for the prospect of ongoing inquiry, let us now turn our attention from the complexity of nature's *physical* makeup to the *nomic* complexity of its lawful comportment.

3. NATURE MIGHT EXHIBIT AN UNENDING COMPLEXITY OF LAWFUL COMPORTMENT

Some theorists – C. S. Peirce, for example – see the opening up of new realms of phenomena in *evolutionary* terms. Early on in world-history, before the evolution of complex molecules, there was no place for biological laws; in the era of Neanderthal man there was no room for

political economy. As the cosmos grows older, new modes of natural organization gradually evolve to afford new phenomena that are governed by emerging laws of their own. We move, say, from laws of individual particles to laws of variously organized complexs thereof. Since the universe affords a varied panorama of modalities of physical process evolving over time, a science that reflects this will always find new grist for its mill.

Still other theorists assume the element of chance and randomness at work in the world, and then contemplate a potentially unending hierarchical order of processes governed by principles that represent statistical summaries, as it were, of lower-level tendencies stabilized under the aegis of the law of large numbers. In this vein, the French physicist Jean Paul Vigier revived along Hegelian lines Pascal's earlier conception of physical nesting, reasoning as follows:

> At all levels of Nature you have a mixture of causal and statistical laws (which come from deeper or external processes). As you progress from one level to another you get new qualitative laws. Causal laws at one level can result from averages of statistical behavior at a deeper level, which in turn can be explained by deeper causal behavior, and so on *ad infinitum*. If you then admit that Nature is infinitely complex and that in consequence no final stage of knowledge can be reached, you see that at any stage of scientific knowledge causal and probability laws are necessary to describe the behavior of any phenomenon, and that any phenomenon is a combination of causal and random properties inextricably woven with one another.[9]

Such an approach envisions an unending hierarchy not of physical structures but of modes of order characterizable through statistical patterns in natural phenomena – and of the causal laws that result from applying the laws of large numbers to extract stabilities from such statistics.

There are two in-principle quite different sorts of complexity hierarchies. One kind is a hierarchy of material systems related by physical inclusion: particles, atoms, molecules, macrolevel physical objects, stars and planets, galaxies, galactic clashes, etc. Or again: molecules, cells, organs, organisms, colonies, etc. However, such *physical* hierarchies of compositional structure stand in contrast to *law* hierarchies of physical order with stages moving from base-level laws that govern phenomena to higher-level laws coordinating laws, and upwards to laws coordinating laws that coordinate laws, and so on. The latter sort of hierarchy of lawful order does not presuppose the former. It can go on indefinitely even in a world whose structural complexity-depth is finite: complexity

of operation does not require complexity in point of physical constitution. Even a world that is finite in the structural complexity of its physical constitution may well exhibit a "hierarchy of nomic orders" with an ongoing sequence of levels of higher-order laws.

In a law-hierarchy, any law is, potentially, a member of a wider family of laws which will itself exhibit some lawful characteristics and thus be subject to synthesis under still "higher" laws. We thus move from laws governing phenomena (1st order laws) to laws governing such laws (2nd order laws) and so on, ascending to new levels of sophistication and comparative complexity as we move along. No matter what law may be at issue, we can ask questions about it that demand an answer in lawful terms. Given such an unending exfoliation of law-levels, new metadisciplines can in theory always spring up to relate old disciplines.

A rather fundamental principle is at work here. Since laws take the hypothetical form "If such-and-such possibilities were realized, such-and-such results would ensue," the finiteness of the manifold of actuality does not entail the finitude of the diversity of laws. Laws, being hypothetical in nature, belong to the domain of possibility, and this domain is not finitized by the finitude of the actual.

It is clear that such an infinite proliferation of laws would also serve to block any prospect of completing science. There is thus no need to suppose that the *physical* complexity of nature is unlimited for nature to have an unlimited *cognitive* depth. After all, the prime task of science lies in discovering the laws of nature, and the ongoing law-complexity of nature suffices for our present purposes of providing for potentially endless discovery.[10]

A supposition of the *structural infinitude* of nature is accordingly not needed to assure nonterminating progress in science. An unending depth in the *nomic complexity* of the world's legal code would be quite enough to underwrite the potential limitlessness of scientific innovation.

But one can go still further.

4. THE PHENOMENA OF NATURE MIGHT BE UNENDINGLY DIVERSE

Even a system that is finitely complex *both* in its physical makeup *and* in its basic law structure might yet be infinitely complex in its actual *operations* over time. For the operations of a structurally finite and nomically finite system can yet exhibit an infinite intricacy in *operational or functional complexity*, manifesting this limitless diversity in the work-

ing out of its processes rather than at the spatio-structural or nomic level. Even were the number of constituents of nature to be small, the ways in which they can be combined to yield products in space-time might yet be infinite. Think here of the examples of letters/syllables/words/sentences/paragraphs/books/genres (novels, reference books, etc.)/libraries/library systems. Even a finite nature can, like a typewriter with a limited keyboard, yield an endlessly varied text. It can produce a steady stream of new phenomena – "new" not necessarily in kind but in their functional interrelationships and thus in their theoretical implications – on the basis of which our knowledge of nature's operations is continually enhanced and deepened.

There is no need to assume a "ceiling" to such a sequence of levels of integrative complexity of phenomenal order. The different levels each exhibit an order of their own. The phenomena we attain at the nth level can have features whose investigation takes us to the $(n + 1)$th. New phenomena and new laws presumably arise at every level of integrative order. The different facts of nature can generate conceptually new strata of operation that yield a potentially unending sequence of levels, each giving rise to its own characteristic principles of organization, themselves quite unpredictable from the standpoint of the other levels. Even a relatively simple world as regards its basic operations can be seen to have an effectively infinite *cognitive* depth, once one proceeds to broaden one's notion of a natural phenomenon to include not just the processes themselves, and the products they produce but also the *relationships* among them.

Consider, for example, some repeatedly exemplified physical concept and contemplate the sequence of 0's and 1's projected according to the rule that $x_i = 1$ if the concept applies (or is exemplified) on occasion number i, and $x_i = 0$ if the concept does not apply on this occasion. Whenever two such concepts, C and C′, generate such sequences, say

C: 0100110100 . . .
C′: 1001011010 . . .,

we can introduce the corresponding *matching sequence* of C and C', 0010010001 . . ., which is such that its i-th position is 1 if the two base sequences *agree* at their respective i-th positions, and is 0 if they *disagree*. Such matching sequences will have a life of their own. For example, even if two base sequences are random, their matching sequences need not be – for example when those base sequences simply

exchange 0's and 1's. (Even random phenomena can be related by laws of coordination.)

Note, moreover, that one can always regard matching sequences themselves as further base sequences, so as to yield "second-order" phenomena, as it were. One can then proceed to examine the relationships between them – or between them and other base sequences. This process yields a potential hierarchy of "laws of coordination" – at level $i + 1$ we have the laws of coordination between sequences at level i. Such a perspective illustrates how simple base phenomena can ramify to bring more and more grist to the mill of study and analysis. Increasingly sophisticated mechanisms of conceptual coordination can lead us to regard the same phenomena in the light of different complexity-levels. Quite different regularities and laws can emerge at different levels.

And there is no reason why this sort of thing cannot go on and on. For the system always exhibits new patterns of phenomenal order over time, and so there is always more to be learned about it. There will always be new levels of functional complexity of operation to be investigated with such a system. It will always be possible to discern yet further levels of structured relationship.

Even when we continue to concern ourselves with the same species of object (e.g., symbols), and the same basic laws (e.g., combination-rules or grammars), we can nevertheless introduce increasingly powerful means of analysis to secure new sorts of data. Consider an analogy. The chess master and the beginner make exactly the same sorts of moves – the individual pieces behave exactly alike for each of them. At this level their realms "are governed by exactly the same laws." An observer exclaims: "I know all about chess. For I have now discovered the rules according to which those pieces move." Splendid? But also naive, since this business of "the basic rules of the game" is of course merely Step One. It is in point of the complexity of their governing principles that masters and beginners differ decisively.

To be sure, that chessboard is limited and finite – and so are the pieces sitting upon it. Moreover, so are the basic "laws of nature" – the moves that the different pieces may make. Nevertheless, the moves of a game of chess are covered by very different categories of "rules" – not just "the rules of the game" that define those basic legal chess moves, but rules of tactics and deeper level principles of strategy. The game can be played – and thus studied – at very different levels of depth or sophistication.

As the analogy of chess makes clear, it is radically mistaken to think that we have gotten to the bottom of things when we merely grasp nature's basic physical laws. The question of what sort of game she is playing by those rules – those *basic* laws – remains open. Even though nature might be of finite physical and nomic complexity as regards its physical structure and its basic procedural laws, nevertheless it could be infinitely diverse in the unfolding operational complexity of its phenomenal products over time. To understand the world about us we need departments of biology and economics as well as departments of physics.

Regardless of the known character of a sequence of phenomena that we confront, we can never rule out the possibility that yet further patterns of relationship exist. For there will be patterns of phenomena, and patterns of such patterns, and patterns of patterns of such patterns – and on and on. We can study letter sequences as such, or move on to the level of words, and thence to sentences, and thence to paragraphs, and so to chapters, to books, to book-categories, to book systems (French vs. Chinese literature), etc. Every new level of consideration will afford phenomena of its own that will themselves admit of further study and analysis. Confronted with repetitive phenomena of any description, inquiry can always in principle find new grist for its mill.

In theory it may occur that just the same relationship-patterns simply recur from level to level – that the patterns of phenomena that we encounter at level $i + 1$ simply reduplicate those already met with at level i. (When it is physical configurations we are dealing with, then this situation of pattern repetition at different levels of scale will yield the "fractal" structures made prominent by E. Mandelbrot.) However, this is a very special case that certainly does not obtain across the board. We have no good reason to think that our world is fractal in the structure of its processes.

But is natural science not bound by a Principle of Simplicity – is it not committed to the idea that nature proceeds in fundamentally simple ways? By no means! We have no ground whatever for supposing the "simplicity" of nature. The so-called 'Principle of Simplicity' is really a principle of complexity-management:

> Feel free to introduce complexity in your efforts to describe and explain nature's ways. But only when and where it is really needed. Insofar as possible "keep it simple!" Only introduce as much complexity as you really need for your scientific purposes of description, explanation, prediction, and control.

Such an approach is eminently sensible. But of course such a principle is no more than a methodological rule of procedure for managing our cognitive affairs. Nothing entitles us to transmute this methodological precept into a descriptive/ontological claim to the effect that nature is simple.

The lesson of such deliberations is clear. As best we can tell, there simply is no realistic prospect that scientific innovation will ever come to a stop. Suppose that we were to discover that:

(i) the world is of limited *structural complexity*: that it is finitely stratified in the subordination and superordination of physical systems so that the world's physical constitution is inherently limited;

AND (ii) the world is of limited *nomic complexity*: that there are only finitely many ("basic") laws of nature;

AND (iii) the world is of limited *descriptive complexity*: that at any given time there are only finitely many realizable states of nature.

Even if all this were to be so – which we have no convincing way of establishing – the theoretical prospect of ongoing scientific discovery nevertheless could not be precluded. Only if we lived in a Nietzschean world of eternal recurrence – a world whose fixed patterns of occurrence reiterated themselves in a vast periodicity of unchanging repetition – could the prospect of ongoing scientific innovation be decisively abolished. And there is, of course, no reason whatsoever that this prospect is even remotely plausible. On the contrary, for aught we can ever say with any confident assurance on the basis of our investigations, the world may exhibit all three of these modes of infinitude.

5. THE BASIS FOR AN UNENDING PROSPECT OF SCIENTIFIC DISCOVERY MIGHT LIE WHOLLY IN THE CHARACTER OF OUR INQUIRY PROCESSES

But there is yet another, more fundamental, aspect to the matter. The usual recourse to an infinity-of-nature principle reflects a strictly one-sided approach that places the burden of responsibility for the incompletability of science solely on the shoulders of nature herself. In its

view, the potential endlessness of scientific progress requires limitlessness on the side of its *objects*, so that the infinitude of nature must be postulated at either the structural or the nomic and/or operational level. But this approach is a mistake. For what really matters for ongoing scientific innovation is *cognitive* rather than *physical* complexity. Scientific innovation – the cognitive exploration of the ways of the world – pivots on the *interaction* of the mind with nature, on the *mind's exploitation of the data to which it gains access* for the sake of penetrating the "secrets of nature." The crucial fact is that scientific progress hinges not just on the makeup of nature herself, but also on the character of the information-acquiring processes by which we investigators investigate it. Responsibility for the *cognitive* inexhaustibility of nature need not lie on the side of nature at all, but can in principle rest one-sidedly with us, its explorers.

As the idea of an inwards spiral shows, even though the distance that separates us from a destination is finite, there is the prospect of making an infinite journey to it – of constant progress towards the goal without even attaining it. (And who is to say that those difficult later steps are inherently no more important that the easier early ones?)

Suppose a natural system to be such that a certain parameter p cannot be evaluated by us at the precise time-point t – for essentially technical reasons – but only on average during an interval around t. In such a case, the system can be very simple indeed – it need contain *no* complexities apart from those required to assure the preceding assumptions – and yet the prospect of endless cognitive progress is nevertheless available. For as our capacity to make p-determinations down to smaller and smaller time-intervals increases from minutes to seconds to milliseconds to microseconds, and so on, we can obtain an increasingly comprehensive insight into the *modus operandi* of the system and can obtain ever fuller information about it that could not have been predetermined on the basis of earlier knowledge. Since averages at levels of larger scale do not determine those at smaller ones, quite different modes of comportment – and thus laws – could manifest themselves at different levels.

Again, suppose a (totally random) sequence of 2s and 3s, on the order of 2 3 2 2 3 . . . and suppose further a transformation that substitutes the pair 10 for 2 and 11 for 3 so as to yield:

10 11 10 10 11 . . .

We are now in a position to ascertain such "laws" as:

(1) The sequence of *even-numbered* positions 01001 . . . will be a random mix of 0's and 1's (which simply mirrors the initial random sequence of 2's and 3's)

(2) All the *odd-numbered* positions are filled by 1's.

We confront a peculiar mixture of randomness with regularity here. But of course it is only by studying *pairs* in that initial zero-one sequence that we can discern its code – the study of statistics that ignores patterns of periodicity will not bring regularities of the sort at issue to our notice. Only by bringing appropriate coordinative *concepts* to bear can we discern the "laws" at issue. And no matter how far we push forward along such lines, the prospect of *further* positional laws can never be eliminated – nor downplayed by claiming that such laws are inherently less significant than the rest.

It becomes crucial in this context that higher-level patterns are not necessarily predictable from lower-level ones. Knowing the frequency with which individual letters like A and T occur in a text will not tell us much about the frequency with which a combination like AT occurs. When we change the purview of our conceptual horizons, there is always in principle more to be learned – novelty that could not have been predicted from earlier, lower-level information.

The introduction of *new conceptual perspectives* is the key. Each time a new discipline opens up its characteristic perspective, a vantage point is gained for the reappraisal of old issues in other fields. (The body of Shakespeare's work is finite, but this does not mean that Shakespeare scholarship will come to the end of the road. Think of how psychoanalysis, for example, or sociology – disciplines that did not exist in the Bard's own day – have been used as launching platforms for innovations in Shakespearean studies.)

The contemplation of such examples shows that the complexity of exfoliating hierarchy-levels need not inhere in the structural makeup of nature herself, but may derive from the conceptual mechanisms being deployed to study it at ever greater depths of sophistication. The case is similar to that of the geometer, whose hierarchy of definitions, axiomatic facts, lemmas, theorems, and so on, does not reside in the geometer's materials as such, but in the conceptual taxonomy that he chooses, for cognitive reasons, to impose on these materials. By herself, nature presumably lacks "depth" altogether. For depth (like difficulty)

is an inherently relative matter, generated through the operation of a cognitive perspective. The endless levels at issue will not be *physical* levels but *levels of consideration* that emerge from the *modus operandi* of inquiring beings. Complexity, after all, lies less in the objects than in the eyes of their beholder. (As Herschel ruminated long ago, particles moving in mutual gravitational interaction are, as we human investigators see it, forever solving differential equations which, if written out in full, might circle the earth.[11])

If we are sufficiently myopic, then, even when the scene we examine is itself only finitely complex, an ever ampler view of it will emerge as the resolving power of our conceptual and observational instruments is increased. When we make measurements at a given level of accuracy, the world may appear X-wise; and when that accuracy is improved by an order of magnitude it may appear Y-wise. At each successive state-of-the-art stage of increased precision in our investigative proceedings, the world may take on a very different nomic appearance, not because it *changes*, but simply because at each stage it *presents* itself differently to us.

Accordingly, the reason for the cognitive inexhaustibility of nature need not rest with nature alone. The character of our information-gathering procedures, as channeled through our conceptual/theoretical perspectives, is also bound to play no less crucial a part.[12] Innovation on the side of data can generate new theories, and new theories can transform the very meaning of the old data. This dialectical process of successive feedback has no inherent limits, and suffices of itself to underwrite a prospect of ongoing innovation in the study of nature. We cannot write FINIS to the book of scientific inquiry as long as the prospect of a *change of mind* on our part regarding the world's workings cannot be precluded.

Such considerations combine to indicate that an assumption of the structural infinity of the physical extent of the natural universe or of the functional infinity of its nomic or operational complexity is simply not required to provide for the prospect of ongoing scientific progress. Continuing discovery is quite as much a matter of how we inquirers proceed with our work as it is of the nature of the object of inquiry. The salient point is that it is *cognitive* rather than *structural or operational* complexity that is the key here, and that cognitive depth need not depend on physical depth.

The facts of the case constrain us to recognize that even a finitely

complex nature can in principle provide the stage for a virtually endless drama of new and significant discovery. There is no sound reason to think that the natural science of even a finite world is an inherently closed and terminable venture, and no adequate basis for insisting that the search for greater "depth" in our understanding must eventually terminate at a logical rock bottom.[13]

6. THE REGULATIVE RATIONALE FOR SUPPOSING THE COGNITIVE INEXHAUSTIBILITY OF NATURE

Admittedly, it is conceivable – all that has been said here notwithstanding – that the world has a finite cognitive depth and that scientific inquiry into its workings will some day come to a definitive end of the road as concerns the discovery of significant novelties. But it should also be stressed that it is difficult to see how one could ever *establish* this termination with significant assurance. How could we ever preclude the prospect that, had we pressed just a bit harder and pushed our inquiries just a bit further, our efforts would have been repaid by new revolutionary discoveries – that new modes of order might have emerged within a setting that, heretofore, just looked like so much noise.

Considerations regarding the mathematical tests for randomness serve to reinforce this point. In randomness screening there are various criteria. To fail any one of them is a decisive impediment to randomness. But surviving any given group of them is indecisive: there are always yet further tests that could still be failed. The unsuccessful search for order up to a given level of sophistication does not establish actual randomness; it is no more than suggestive, seeing that the possibility of order at a deeper (yet uncontemplated) level of sophistication cannot be precluded. There is no *effective* procedure for randomness-determination, and so the search for order can never be terminated with unalloyed confidence that further effort in the search for order is fruitless. Accordingly, there can be no adequate justification for writing off the search for order in nature once and for all.

In the face of this circumstance, we would do well to take it as a regulative principle – a methodological working hypothesis – that nature's cognitive depth is not finite and that a sufficient further effort will, in principle, meet with further discoveries.

To be sure, this entire discussion of the incompletability of science has proceeded at the level of plausible possibilities. Its argumentation moves

as follows: (1) The incompleteness of science – the availability of lawful regularities in nature extending beyond those we have been able to discern – can never be precluded as a theoretical prospect. (2) There are good methodological (and thus *practical*) reasons for regarding our science as incomplete at any given stage. *Therefore*: We are well advised to regard science as incompletable. The fact remains that it is only by being prepared to suppose that science-as-we-have-it is incomplete can we clear the way for an ongoing endeavor to move the frontiers forward.

Of course, the effort to advance our scientific probes of nature is not easy, the work not inexpensive.[14] The course of convenience and the call of other desiderata ever conspire to urge a slackening of effort in training scientists and in funding their endeavors. And the comforting thought that nothing substantial remains to be done provides a perfectly respectable-looking excuse here. The forces of anti-intellectualism in society and in government are ever on the lookout for reasons to keep science on a short financial leash. Perhaps there indeed are such reasons. But the claim that science stands on the verge of completion – that all the great discoveries have been made and that only a few mere details remain to be filled in – is certainly not one of them.[15]

CHAPTER FIVE

ON THE PROBABILISTIC BEARING OF TESTIMONY

1. INTRODUCTION

The problem-domain which we will discuss was broached by Condorcet in his classic memoir on the theory of probability during 1781–1784. Here he deliberated about

> la contrarieté d'opinions entre deux classes de philosophes. Les uns ne peuvent se persuader que les mêmes témoignages puissent produire, pour un fait extraordinaire, une probabilité égale a celle qu'ils produisent pour un fait ordinaire; et que, par exemple, si je crois un homme de bon sens qui me dit qu'une femme est accouchée d'un garcon, je dusse le croire egalement s'il me disoit qu'elle est accouchée de douze.
>
> Les autres au contraire sont convaincus que les temoignages conservent toute leur force pour les faits extraordinaires et très-peu probables, et ils sont frappés de cette observation, que si on tire une loterie de 100000 billets, et qu'un homme, digne de foi, dise que le numero 256, par exemple, à eu le premier lot, personne ne doutera de son témoignage, quoiqu'il y ait 99999 a parier contre un que cet événement n'est pas arrivé.[1]

Clearly, the question of how to evaluate the probability of the contentions at issue in the testimony of witnesses has been a matter of dispute for a long time. But unfortunately, confusion continues to surround the issue. The object of the present discussion is to illustrate this state of affairs and to explain why it prevails.

2. THE RELIABILITY OF SOURCES

Suppose a rather reliable (but not infallible) source tells us something that is relatively improbable (but not impossible). We now have two choices:

(1) To hew to the reliability of the source and take that improbability in our stride, or

(2) to yield to the improbability of what is reported and assign this case to those (relatively infrequent) occasions when our source is wrong.

In such cases, we face a conflict of probabilities. On the one hand, it seems probable that the report is wrong – since what it maintains is

improbable. Nevertheless, general principles suggest the report is probably right – since it stems from a reliable source. Which side is rational man, for whom "probability is the guide of life", inclined to favor in such a situation?

Let us set out from the supposition that, in considering the claims of our source, we can plausibly regard the entire group of its relevant declarations as divided into two parts. One part contains cases ($p \in K$) where the source really "knows what it is talking about" and is accordingly bound to be right, and the other ($p \notin K$) contains those cases it does not know about and thus may well be wrong about. Let the respective sizes of these two groups be a and b.

Given these quantities, our source's competency is indicated by the ratio $a/(a+b)$, and we may construe this ratio to represent our source's "index of knowledgeability" (k):

$$k = a/(a+b).$$

This quantity k measures the (relative) size of S's overall relevant assertions (A_s) where it really "knows what it is talking about" in the sense of being accurately informed. (We accordingly have it that the generic probability that a randomly selected assertion of our source, within the relevant domain, belongs to its region of knowledgeability is k, and that the probability of its failing to do so is $1 - k$.) Now let us further adopt the definition:

Z = the average *a priori* probability of statements (in the relevant domain) that are made by our source:

$$Z = [\text{av: } p \in A_s]\ \text{pr}(p).$$

On this basis, our source's overall performance record is to be determined as follows. Its overall reliability (r) – the proportion of cases where it manages to "get things right" – would presumably be a result of two components:

(i) Complete success within its "region of knowledgeability".

(ii) Merely average success outside its "region of knowledgeability".

In consequence, we have:

(0) $\quad r = k \times 1 + (1 - k) \times Z.$

Note that r in effect represents the average *a posteriori* probability of our source's statements:

$$r = [\text{av}{:}p \in A_s]\ \text{pr}(p//S \text{ says } p).$$

Solving equation (0) for k, we have it that $k = (r - Z)/(1 - Z)$. From this it follows that if we assume that the statements at issue have (on average) a smallish *a priori* probability, so that Z is close to zero, then we may suppose it to be a fair approximation that:

$$r \cong k.$$

On the other hand, with largish *a priori* probabilities ($Z \cong 1$), it transpires (since $r = k(1 - Z) + Z$), only having $k = 0$ will keep r maximally away from 1.

When dealing with *particular subdomains* in this range of our source's statements, it is a consequence of the relationship (0) that r will vary *both* with the source's knowledgeability (the local value of k) *and* with respect to the average *a priori* probability of statements of the subdomain (the local value of Z). To fail to recognize this fact, and to think of r as a topic-neutral constant for a given source, is to fall victim to the *Myth of Uniform Reliability*. Obviously this *is* a myth because this probability is bound to depend on just how p is situated in S's overall sphere of knowledge.

The calculus of probability instructs us that:

(1) $\text{pr}(S \text{ speaks truly in asserting } p) = \text{pr}(T(p))$
$= \text{pr}(p \in K) \times \text{pr}(T(p)//p \in K) + \text{pr}(p \notin K) \times \text{pr}(T(p)//p \notin K)$.[2]

As indicated above, we suppose that:

(i) Our source is totally reliable *within* the range of its "well-based knowledge," so that

$$\text{pr}(T(p)//p \in K) = 1.$$

(ii) Outside the range of its well-based knowledge, our source is of strictly average reliability: if it "gets it right", it is purely by fluke and chance. Its performance here is strictly in line with the *a priori* probability of p:

$$\text{pr}(T(p)//p \notin K) = \text{pr}(p).$$[3]

Accordingly, formula (1) now yields:

(2) $\text{pr}(S \text{ speaks truly in asserting } p) = \text{pr}(T(p)) = k \times 1 + (1 - k) \times \text{pr}(p)$.

On this basis we obtain:

(3) $\quad \text{pr}(T(p)) = \text{pr}(p) + k \times \text{pr}(\text{not-}p).$

From whence it follows that, since $0 \leqslant k \leqslant 1$,

$$\text{pr(p)} \leqslant \text{pr}(T(p)) \leqslant 1.$$

Note that we reach the former extreme when $k = 0$ and the latter when $k = 1$. By virtue of (3) we see that $\text{pr}(T(p))$ is maximized when $k = 1$. A highly knowledgeable source (relative to a subdomain of assertion) is one for which $\text{pr}(T(p))$ is generally high – a source that manages to impart a high *a posteriori* probability to its claims.

Observe that formula (3) yields:

$$\text{pr}(T(\text{not-}p)) = \text{pr}(\text{not-}p) + k \times \text{pr}(p)$$

Thus:

$$\text{pr}(T(\text{not-}p)) = 1 - (1 - k)\text{pr}(p)$$

And, given (2), we obtain:

$$\text{pr}(T(\text{not-}p)) = 1 - \text{pr}(T(p)) + k.$$

The negation law for *a posteriori* probabilities is *not* the same simple one that holds for *a priori*. The fact that sources can speak truly by mere chance creates a complication.

Given this background, let us return to the particular example of the second paragraph of Condorcet's discussion and examine the case of the man (S) who tells us (after the event) the number that comes up in a certain lottery (of 100,000 tickets). His record of reliability r in similar performances in the past is (we may suppose) relatively high, say 90 per cent. What, then, is the probability that our informant is correct on this occasion?

Here we have:

$$\begin{aligned} \text{pr}(p) &= 1/100{,}000 \\ k = r &= 0.9. \end{aligned}$$

So, by (2) we obtain that:

$$\text{pr}(T(p)) = 0.9 + 1 \times 10^{-5}.$$

For all practical purposes, the *a posteriori* probability that the source S's claim is true, given his having made it, can be set at his performance

record of 0.9. On *this* issue, the theoreticians of paragraph two of the Condorcet passage are clearly correct in the analysis of their example.

3. THE KNOWLEDGEABILITY OF SOURCES

In general, the relationship between pr(p) and pr($T(p)$), as stated in equation (3) above is depicted by the parametrized family of straight lines set out in Figure 1.

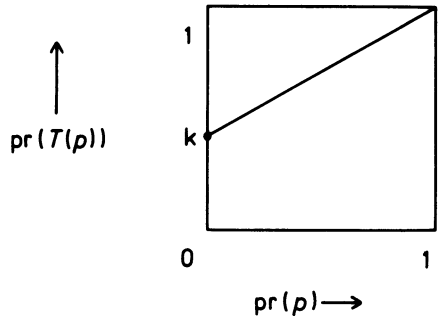

Fig. 1.

From this relationship, it follows that pr($T(p)$) $\geq$ pr(p)), as must be the case with any creditable source. (We must assume that we are not dealing with a "reliable counter-indicator".) Moreover, (3) yields the consequences set out in Table I.

Figure 1 makes it clear that, as a source's reliability increases, the intrinsic improbability of its assertions becomes less and less relevant. For largish k, we obtain rather large values of pr($T(p)$) even for very small values of pr(p). (To re-emphasize, the theoreticians of Condorcet's second paragraph are quite right about their example.)

Here is one salient lesson of these deliberations. With a reliable source, the intrinsic (*a priori*) probability of a report becomes immaterial to its (the report's) credibility. The reliability of the source dominates the improbability of its reports. With one important qualification! The approach at issue pivots on our recourse to

$$k = a/(a + b).$$

This represents our source's index of knowledgeability with respect to

TABLE I
Relationships that follow from the basic equation
$\text{pr}(T(p)) = \text{pr}(p) + k \times \text{pr}(\text{not-}p)$

	k	pr(p)	pr($T(p)$)
(1)	high	high	high
(2)	high	middling	high
(3)	high	low	high
(4)	middling	high	high
(5)	middling	middling	middling/high
(6)	middling	low	middling
(7)	low	high	high
(8)	low	middling	middling
(9)	low	low	low

Note 1: Here "high" means $\cong 1$; "low" means $\cong 0$; and "middling" means $\cong 1/2$.
Note 2: Only in cases 2, 3, 5, and 6 is pr($T(p)$) substantially greater than pr(p). It takes a (relatively) reliable source to upgrade an *a priori* probability.

"the *relevant* domain of its statements". But in the particular case where $\text{pr}(p) \cong 0$, where "p is effectively impossible", the relevant range will be that of those cases where S has knowledge that something impossible has occurred. Here, of course k will effectively be zero: $k \cong 0$. Now, $\text{pr}(p) \cong 0 \cong k$, so that, by (2) on page 60 we obtain:

$$\text{pr}(T(p)) \cong 0.$$

Those theorists who refuse to follow even a reliable source into the realm of *a priori* impossibilities are also quite right. The Roman proverb "I should not believe such a story were it told me by Cato" holds true.[4] And so, the theoreticians of Condorcet's first paragraph are *also* correct with respect to the particular example they have in view.

4. SOME VARIATIONS

It is interesting to contemplate in the light of these deliberations the situation that arises when two *independent* sources of weakish reliability attest to the same event.

To elucidate this, suppose that two such sources, S_1 and S_2, both assert a certain thesis p (whose *a priori* probability is quite small, say $\text{pr}(p)=0.001$), and that

r_1 = S_1's reliability = $0.3 \cong k_1$
r_2 = S_2's reliability = $0.3 \cong k_2$.

A large degree of uncertainty will prevail here because we know so little about the overlap between the regions of knowledgeability of those sources. Thus k^*, the aggregate or conjoint "index of knowledgeability" of our two sources, can lie anywhere between 0.3 (total overlap) and 0.6 (no overlap at all). Accordingly, all that we obtain when we make our calculation via the basic formula (3) above is that:

$$0.301 \leqslant \text{pr}(T(p)) \leqslant 0.600$$

If we deem our witnesses to have substantial regions of knowledgeability, the result of the independent testimony of both will clearly be more probable than that of the testimony of either. But the mutual corroboration of (independent) witnesses generally improves the probabilistic situation – even where relatively unreliable witnesses are involved.

Observe however that the preceding calculation contrasts sharply with the result of the "naive" calculation:

pr(S_1 is wrong) = 0.7.
pr(S_2 is wrong) = 0.7.
pr(both are wrong) = 0.49.
pr(at least one is right) = 0.51.
pr ($T(p)$) = 0.51.

This "naive" calculation is quite inappropriate. As J. M. Keynes has rightly pointed out, it ignores the fact that both sources are making *the same* statement, nor does it take the *a priori* probability of that statement into account in any way.[5]

Another interesting issue also arises. How does the preceding line of approach function when relatively reliable sources issue *conflicting* reports?

Suppose that two sources S_1, and S_2, of reliability $r_1 = k_1$ and $r_2 = k_2$, declare that p and not-p respectively. (See Figure 2) We now have:

$$\text{pr}(T^*(p)) = \text{pr}(p \in K_1 \,\&\, p \notin k_2) \times 1 + \text{pr}(p \notin K_1 \,\&\, p \in K_2) \times 0 + \text{pr}(p \notin K_1 \,\&\, p \notin K_2) \times \text{pr}(p).$$

We note that the relative sizes of the three regions K_1, K_2, and H are k_1, k_2, and h respectively. The preceding formula yields the picture of Figure 2:

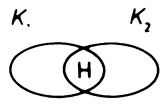

Fig. 2. Two sources with overlapping regions of knowledgeability.

The extent of the overlap between k_1 and k_2 – the redundancy of the "region of knowledgeability" of our two sources represented by the quantity h – again becomes a salient consideration. When it transpires that we know *nothing* further about the relation between the "regions of knowledgeability" of our sources, then all we have is:

$$0 \leqslant h \leqslant \min[k_1, k_2].$$

This may not be very much. But all the same it provides us with something to go on. Even this very modest bit of information is still progress. For despite the conflict of our sources, we know in the wake of their testimony that the probability of the contention p viewed *a posteriori* is something we can estimate on the basis of peripheral information.

Consider a thought experiment. Suppose that a source informs you:

(1) that a certain object is candlestick.
(2) that it is made (totally) of brass.
(3) that it measures fifteen inches across its maximum dimension.

Suppose further that you are reliably informed that this source is relatively unreliable – that there is, on average, only a modest likelihood, say 60 per cent, that any given item of information it provides is actually correct. What can one now say about the item in question?[6]

Rather little! You cannot even say with substantial confidence that there is an *object* at issue, a single "thing" of some sort rather than a pile of brass pieces – which could, after all, still make (2) and (3) true.

What you can say with fairly high probability (say 90 per cent or more) is that *at least one* of (1)–(3) is true. And from *any* one of these points certain things follow, given the rest of our knowledge of the world's ways. In particular, we can confidently say that the item at issue is:

(i) Something material, a physical entity located in the world's space-time framework;
(ii) Larger than an electron and smaller than the moon;
(iii) Of a weight less than 10 tons.

The security of these claims lies in their following on from *each* of the items (1)–(3) and thus from their *disjunction*. Accordingly, we do possess a fair amount of highly probably, albeit *very vague* information about the item at issue.

Consequently, we can garner a vast amount of negative information about this item:

- it is not a photon;
- it is not a number;
- it is not a letter of the alphabet;
- it is not a poem;
- it is not a mountain range.

All the same, we have *virtually no specific positive information* about the item at all: we can answer no specific question about it with high confidence. At the level of significant detail we can say nothing concrete about it. The only questions we can answer confidently are those that allow a very high level of generality:

Q: "How large is the item at issue?"
A: "Larger than an electron and smaller than the moon."

Now suppose that the source provides some further data regarding the issue, for example:

(4) That it weighs two pounds.
(5) That it was made in Cleveland.

We can now reason as follows. The probability that *at least two* of our five data are true is high (say 90 per cent or more). But *any and every pair* of these five thesis will entail not only (i) and (ii) above, but now more specifically:

(iv) That it is larger than an atom and smaller than the Queen Mary.
(v) That it weighs between 1 micron and 1 ton.

As we accumulate more information – even at the same level of imperfect reliability (let alone at improved levels!) – we can extend the range of information obtained at any given level of security. This information is certainly not pitched at the same level of definitiveness (informativeness) as that of the premisses with which we began. It is more vague, loose, and imprecise – more indefinite. This shortcoming is the price we pay for its enhanced security.

These deliberations make clear that the probability of a claim made by an imperfect source is something that very much depends not only on this source's reliability (its correctness on the average), but also on the statement's particular character and its relation to the source's other declarations. It is worth re-emphasizing the point stated above. To think of a source's "reliability" as a topic-neutral constant is a mistake because this matter of "the (*a posteriori*) probability of source statements" is bound to depend on just exactly how they are situated in the source's overall sphere of knowledge – i.e., how *this* claim is related to its other claims.

5. A SURVEY OF PROBATIVE VIRTUES

Let us map out systematically the sorts of *probative virtues* that a source may have. In doing this it is helpful to consider the diagram presented in Figure 3.

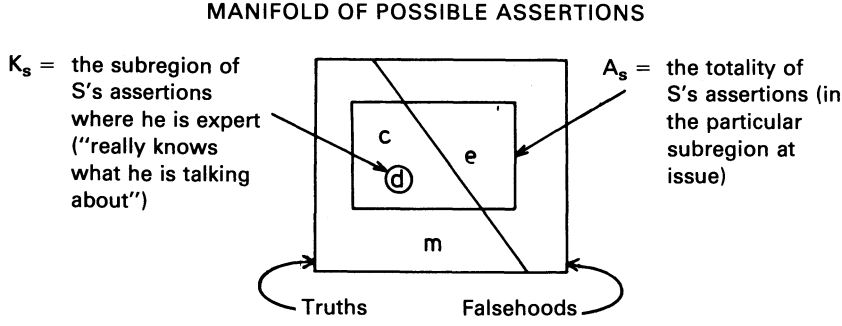
MANIFOLD OF POSSIBLE ASSERTIONS
K_s = the subregion of S's assertions where he is expert ("really knows what he is talking about")
A_s = the totality of S's assertions (in the particular subregion at issue)
c
e
d
m
Truths
Falsehoods

Fig. 3. Parameters of assertion

The following conditions will obtain:

(i) A knowledgeable source imparts a high (*a posteriori*) probability to *all* of its statements. And so, S is a *knowledgeable* source (within the subdomain A_s at issue) when d is comparatively large, i.e., iff $k = d/(c + d + e)$ is relatively high – say, > 0.9.

Note: $k = 1$ iff $c = e = 0$. For a knowledgeable source ($k \cong 1$) we know from formula (3) on p. 61 that $\text{pr}(T(p)) \cong 1$. Therefore a source is knowledgeable if and only if c and e are relatively small.

(ii) S is an *informative* source (within the subdomain at issue) only if the average *a priori* probability (Z) of S's assertions within the subdomain A_s is relatively low – say $Z = [\text{av:}p \in A_s]\ \text{pr}(p) < .01$.

Note: By (0) we know that $Z = 0$ iff $k = r$. But $r = [\text{av:}p \in A_s]\ \text{pr}(p//S \text{ says } p) = (c + d)/(c + d + e)$. And $k = d/(c + d + e)$. These two quantities will be equal if and only if $c = 0$. Therefore a source is informative if and only if c is relatively small.

(iii) S is a *reliable* source (within the subdomain at issue) iff $\text{pr}(p//S \text{ says } p)$ is relatively high, on average, for propositions of this subdomain, say, > 0.9.

Note: $r = [\text{av:}p \in A_s]\ \text{pr}(p//S \text{ says } p) = (c + d)/(c + d + e)$. According $r = 1$ iff $e = 0$. And so a source is reliable if and only if e is relatively small.

(iv) S is an *accurate* source (within the subdomain at issue) if and only if pr(S says p//p) is relatively high, on average, for propositions of this domain, say, > 0.9.

Note: $[\text{av:}p \in A_s]$ pr(S says p//p) $= (c + d)/(m + c + d)$. Accordingly this quantity is $= 1$ iff $m = 0$, so that a source is accurate if and only if m is relatively small.

It should be stressed that these conditions are such that the following relationships obtain:

Knowledgeable $\rightarrow$ informative.
Knowledgeable $\rightarrow$ reliable.
(Informative and reliable) $\rightarrow$ knowledgeable.

Observe, however, that we do *not* have:

pr(p//S states p) is high $\rightarrow$ pr($T(p)$) is high

For the antecedent of this implication comes to

$(c + d)/(c + d + e) = 1$ or equivalently $e = 0$

While in virtue of (3) above the consequent comes to

$$\text{pr}(p) + k \times (1 - \text{pr}(p)) = 1$$
$$k\,(1 - \text{pr}(p)) = 1 - \text{pr}(p)$$
$$k = 1$$
$$d/(c + d + e) = 1 \text{ or equivalently } c = e = 0$$

which does *not* follow from $e = 0$ alone!

When pr(p) is known, then by the relations of Figure 3, it is necessary (and sufficient) to know something about k in order to say something informative about pr($T(p)$). Thus, given that $k = d/(c + d + e)$, we cannot say *anything* in general about pr($T(p)$) if all that we have is that the source in question is informative ($c = 0$ only) or is accurate ($m = 0$ only).

Plausibly, we require rather powerful general information about our sources before we can say anything about the (*a posteriori*) probability of the truth of their assertions.

The overall situation regarding "probative virtues" is summarized in Table II, which makes perspicuous the relationships that obtain among these factors.

TABLE II
A survey of probative virtues
(in terms of the parameters of Figure 3)

Virtue	Condition
1. *informativeness*	c relatively small $c \cong 0$
2. *reliability* (Few Type 2 errors of commission)	e relatively small $e \cong 0$
3. *accuracy* (Few Type 1 errors of omission)	m is relatively small $m \cong 0$
4. *knowledgeability*	$c \cong 0$ and $e \cong 0$
5. *sagacity*	$c \cong 0$ and $m \cong 0$
6. *trustworthiness*	$e \cong 0$ and $m \cong 0$
7. (near) *omniscience*	$c \cong 0$ and $e \cong 0$ and $m \cong 0$

6. THE TAXICAB PROBLEM

Consider the following problem, which has figured prominently in the experimental psychology of probabilistic reasoning:

> Two cab companies, the Blue and the Green, operate in a given city. Eighty-five per cent of the cabs are Blue, and the remaining 15 per cent are Green. A cab was involved in a hit and run accident at night. A witness identifies the cab as a Green cab.
>
> The court tested the witness' ability to distinguish a Blue cab from a Green cab at night by presenting to him film sequences made under these conditions, half of which depicted Blue cabs, and half Green cabs. He was able to make correct identification in 8 out of 10 tries. He made one error on each color of cab.
>
> What do you think is the probability (expressed as a percentage) that the cab involved in this accident was Blue?[7]

Adopting our previous methodology, we would proceed here by splitting the overall range of cases into two: those where the witness actually "got a good look", presumably being able to identify the color correctly in *all* such cases, and those where he "got a poor look" and was right only randomly, "on the average".

Given these data, the probability that a green cab was involved in the accident, as the witness claimed, can be calculated as follows:

$$\text{pr(green)} = 0.15$$
$$r = 0.8$$

We may safely suppose that we are dealing with statements of fairly high average *a priori* probability, so that (say) $Z = 0.3$. Then by (0) above we have

$$0.8 = k + (1 - k) \times 0.3$$

so that $k = 0.7$ – i.e., k is a bit less than r. Using formula (3) on page 61, the probability that our witness speaks the truth in claiming that the taxi involved in the accident was green is:

$$\text{pr}(p) + k \times \text{pr}(\text{not-}p) = 0.15 + (0.7)(0.85) = 0.75.$$

When this case was presented to experimental subjects in a psychological investigation, the mean-estimated probability was 0.8, which accords with our preceding result. However, the psychologist investigators (Kahnemann and Tversky) claimed that this involves a serious error.[8] As they see it, the calculation should proceed as follows. Consider the tabulation of probabilities given in Table III. By the problem's defining hypothesis, we are given that:

(1) $x + v = 0.8$ (since our witness W is, *ex hypothesi*, right 80 per cent of the time overall)
(2) $x + y = 0.85$
(3) $u + v = 0.15$.

Unfortunately, these three equations with four unknowns are insufficient to enable us to draw any numerical conclusion regarding the four values at issue. At this point our investigators proceed to construe the given information to mean:

$$\text{pr}(W \text{ says blue//blue}) = \text{pr}(W \text{ says green//green}) = \text{pr}(W \text{ says } p\text{//}p) = \text{constant}$$

so that

$$x/(x + y) = v/(u + v) = \text{constant} = 0.8.$$

This means that our investigators suppose (on feeble justification) that the accuracy of the witness at issue is context-invariant. On the flimsiest data, they adopt the stance that because a source has a certain accuracy-level in one color-context, it will have that selfsame accuracy-level in a different color-context. They have succumbed to the fallacy inherent in the *Myth of Uniform Accuracy*.

On this (problematic) basis, one can of course proceed to calculate the outcomes:

TABLE III
Tabulations of probabilities

		Witness says *Blue*	Witness says *Green*	*Sum of row*
True color	*Blue*	x = pr(blue & W says blue)	y = pr(blue & W says green)	$x + y$ = pr(blue)
	Green	u = pr(green & W says blue)	υ = pr(green & W says green)	$u + \upsilon$ = pr(green)
Sum of column		$x + u$ = pr(W says blue)	$y + \upsilon$ = pr(W says green)	1.0

Notes: (1) pr(green//W says green) = pr(green & W says green)/pr(W says green)
$= \upsilon/(y + \upsilon)$.
(2) pr(W says green//green) = pr(green & W says green)/pr(green)
$= \upsilon/(u + \upsilon)$.

$x = 0.68 \quad y = 0.17$
$u = 0.03 \quad v = 0.12.$

And so our investigators accordingly conclude:

pr(green//*W* says green) = 0.41
pr(blue//*W* says green) = 0.59.

As they see it, it is relatively likely that a blue cab was involved in the accident, even though a generally reliable witness claims that it was a green one. But this conclusion has been drawn on the basis of a very questionable supposition.

Recourse to the Myth of Uniform Accuracy enables one to gloss over the fact that the problem is informationally underdetermined. For a sensible resolution to be made, *further substantive suppositions* are needed. And those suppositions (seemingly) made by their subjects (essentially those embodied in our initial calculation) are every bit as good (or bad) as those favored by the investigators themselves.

Kahnemann and Tversky's complaint that their experimental subjects processed the information of the taxicab problem incorrectly itself rests on a distinctly dubious basis. Their subjects are not deficient in their ability to reason probabilistically. Simply (and quite naturally), they adopt a set of *material* assumptions different from those that these investigators themselves propose to adopt (with very little justification).

7. HUME AND LAPLACE ON HUMAN TESTIMONY

David Hume held that we cannot accept the testimony of an interested witness, and Laplace reinforced this view with mathematical argumentation.[9] He concluded that if the witness has a personal stake in the issue, he will be tempted to lie, and that this circumstance will greatly reduce the probability that his contention is correct.

Laplace's view is, however, of very doubtful soundness. From the two premisses,

> *X* claims to have good evidence for maintaining *p* (e.g. that he saw this with his own eyes);

and

> *X* lies; he actually has no good evidence on the issue but spoke from interest alone,

nothing whatsoever follows regarding the probability of p. The probability of the substance of a claim is clearly unaffected by the fact that those who make the claim have no adequate warrant for it, and are completely ignorant of the matter at hand.

We ask Smith whether heads will come up on the next toss of coin. Purporting infallible foresight in these matters he brazenly claims: "Of course it won't." Let it be granted that he does not have a clue and is lying. Does that make the probability of heads zero? The Laplacean argument turns on the equivocation of "lie" meaning *speak falsely as to the FACT of one's claims*, on the one hand, and "lie", on the other hand, meaning to *speak falsely as to the JUSTIFICATION of one's claims*. The circumstance that an interested witness could "lie" in this second sense may plausibly disincline us to accept his testimony. But it does nothing to establish the actual falsity – or improbability – of his claims. (On the basis of groundlessness, we can get no further than the Scots' verdict, "not proven" – actual falsehood is something else again.)

There are two sorts of "liars". One sort consists of those who simply speak forth without any care for the grounds of their assertions – and who thus manage to tell the truth with only random success:

(i) $\quad r = \text{pr}(p//S \text{ says } p) = \text{pr}(p).$

The other sort of liar is one who deceitfully asserts what he actually has good reason to deem false, and accordingly tells the truth with less than average frequency. Such people are relatively reliable indicators – but of falsehood rather than truth:

(ii) $\quad r = \text{pr}(p//S \text{ says } p) < \text{pr}(p).$

Impropriety and "falsification" are involved in both cases, but in the first case what is misleading relates to the *basis* of one's claims, and in the second case what is misleading relates to the *substance* of one's claims. Basis liars are ignorant and *irresponsible*; substance liars are well-informed but *deceitful*.

Both sorts of liars are untrustworthy, but in rather different ways. From (i) we may infer,

$$\text{pr}(S \text{ says } p//p) = \text{pr}(S \text{ says } p).$$

Here the truth of his assertions is simply irrelevant to our source's assertions. On the other hand, from (ii) we infer

$$\text{pr}(S \text{ says } p//p) < \text{pr}(S \text{ says } p).$$

Here the truth of an assertion renders its being asserted by S less likely. A basis-liar is truth-indifferent, a substance liar is truth-aversive; the latter avoids truth while the former ignores it. Lying of the one kind is a matter of blindness to the truth, lying of the other kind is a matter of falsity tropism – of outright deception.

Basis liars are readily accommodated within our machinery. For such a liar we have (by assumption)

$$r = \text{pr}(p) = Z.$$

And thus by formula (0) above we have $k = 0$, whence, by (3):

$$\text{pr}(T(p)) = \text{pr}(p).$$

A basis-liar is unable to make any probative contribution towards our probability evaluations: his testimony leaves the situation exactly in the *status quo ante*. A substance liar, on the other hand, makes a definite (albeit indirect) contribution. For the fact of its assertion by a substance-liar renders a thesis less probable than it was before. But the fact of it assertion by a basis-liar leaves the epistemic situation precisely where it was to begin with: the probability of the claim remains unaffected.

Against this background, it transpires that the Hume/Laplace analysis turns on the stance that an interested witness proceeds with actual deceitfulness (i.e. "really *knows better*"). This seems far-fetched. It requires that the witness knows the true facts and counterindicates them, rather than merely being caught up in a self-deception which jumps to an ungrounded conclusion because "the wish is father of the thought". And this, of course, makes for a highly problematic *substantive* assumption.

8. LAPLACE ON TESTIMONIAL CHAINS

In considering "the influence of time upon the probability of facts transmitted by a chain of traditionary witnesses," Laplace says: "It is clear that this probability ought to diminish as the chain is prolonged" seeing that the probability "which it [a statement] acquires by the testimony decreases according to the combined product of the veracity of the witnesses."[10]

Now consider the standard sequence of testimonial transmission:

$p_1 = W_1$ says p
$p_2 = W_2$ says W_1 says p
$p_3 = W_3$ says W_2 says W_1 says p
$p_4 = W_4$ says W_3 says W_2 says W_1 says p
$p_i = W_i$ says p_{i-1}.

On this basis[11], then, we have it that:

$$\text{pr}(p_i) = \text{pr}(W_i \text{ says } p_{i-1}).$$

The relevant mode of "veracity" will clearly be:

$$V_i = \text{pr}(p_{i-1} // W_i \text{ says } p_{i-1}) = \text{pr}(p_{i-1} // p_i).$$

If what Laplace says were correct, and the probability which a statement "acquires by the testimony decreases according to the combined product of the veracity of the (transmitting) witnesses", then we would have:

$$\text{pr}(p // p_2) = V_1 \times V_2 \times f(\text{pr}(p)) = \text{pr}(p // p_1) \times \text{pr}(p_1 // p_2) \times f(\text{pr}(p))$$

where f is some suitable function in which the *a priori* probability alone will play a role. And generally this is not true. For to claim this would be to claim:

$$\frac{\text{pr}(p \,\&\, p_2)}{\text{pr}(p_2)} = \frac{\text{pr}(p \,\&\, p_1)}{\text{pr}(p_1)} \times \frac{\text{pr}(p_1 \,\&\, p_2)}{\text{pr}(p_2)} \times \text{f}(\text{pr}(p)).$$

This is equivalent to:

$$\frac{\text{pr}(p \,\&\, p_2) \times \text{pr}(p_1)}{\text{pr}(p \,\&\, p_1) \times \text{pr}(p_1 \,\&\, p_2)} = \text{f}(\text{pr}(p)).$$

But the falsity of this contention is obvious, seeing that the left-hand side is emphatically *not* something that will hinge on pr(p) alone but brings upon the stage matters that will vary with the particular witnesses at issue. What Laplace claims thus clearly does not hold for traditionary situations. Only if we adopt a special assumption that clearly begs a lot of questions would it transpire that the sort of relationship claimed by Laplace obtains.[12]

It is clearly not in the *probability mathematics* that Laplace's analysis goes wrong, but in regard to the *substantive assumptions* that can plausibly be made in the sorts of situations at issue.

9. THE MORAL OF THE STORY

The various cases we have considered teach a general lesson. What makes probabilistic reasoning about matters of testimony tricky and controversial is *not* that the mathematics of the thing is so complicated. On the contrary, the probability arithmetic of the matter is usually simplicity itself. The difficulty is that in order for the mathematics of these probability calculations to get a purchase-hold on the question, we must make certain *substantive assumptions* about just how we construe a problem's data. Generally, we need more information than an abstract formulation of the issue affords us to get the machinery of the probability calculus to connect with the given numbers. And this is where difficulties arise. For, as we have seen, there is a tendency for analysts to look for an "easy way out" – to facilitate the process of calculation by making inappropriate or eminently problematic substantive suppositions.

It is easy – and tempting – to commit errors in appraising the probabilistic bearing of testimony. But the errors that arise tend to involve mistakes not of calculation but of improper reliance on questionable assumptions. The difficulty is that any concrete application of probabilistic machinery requires the undertaking of substantive commitments. And these can, all too readily, involve suppositions that are not adequately warranted by the facts in hand.

CHAPTER SIX

THE LIMITS OF PROBABILISTIC EPISTEMOLOGY

1. THE PROBABILIST PROGRAM

There is a large grain of truth in Bishop Butler's dictum that: "Probability is the guide of life". Probability no doubt affords substantial guidance to *practical* decision making. But there is no good reason to think that it can by itself provide an adequate basis for specifically *cognitive* decision making.

As the probabilistic program in epistemology sees it, knowledge *always* roots in mere probabilities. Propositional acceptance is thus a two-stage process. Initially, at stage one, we have *only* probabilistic information regarding the matters at issue. Subsequently, at stage two, we use this probabilistic information to determine – somehow or other – which claims actually to accept. As probabilists generally see it, moreover, those initial probabilities are virtually never zero or one, so that the problem of moving from *mere* probabilities to actual acceptabilities is pervasive and unavoidable.

The radically probabilistic epistemologist who concerns us here is someone who holds this sort of position, regarding the assessment of probabilities as somehow basic to human judgment in matters of fact in general. He holds that the validation of *all* such acceptance is ultimately based in probabilistic commitments.

Such a radical probabilism has two varieties: local and global. Local probabilists maintain their position only with respect to limited ranges of factual propositions – instrument readings, for example, or perceptual judgments. Only the propositions of some limiting class are held to be based in probabilities – only they must always be epistemically grounded in mere probabilities. Global probabilists, by contrast, maintain the position across the entire cognitive front – with respect to *all* factual claims that we accept. It is this global position that will be the target of the present critique – the view that rational factual judgments are always grounded in preestablished probabilistic claims.

2. PROBABILITY IS NOT ENOUGH

The shortcoming of the strong, globally probabilist position roots deep. For merely probabilistic information as such does not enable us to answer our questions about the world. I ask "What is Smith's height?" To be told that the answer lies in a probability distribution across a spectrum of values tells us nothing specific about Smith's height; it could, for all we know to the contrary, be *anything* within the range at issue. To have a viable epistemology – to get answers to our questions – we must take the step from stage one to stage two by somehow effecting a transition from probability to acceptability. But accomplishing this is difficult to the point of infeasibility.

To start with, probable statements do not thereby gain a hold on truth. Nor, again, does its improbability (i.e., low probability) entail the falsity of a thesis: an improbable contention is not thereby rendered false – improbable things happen all the time. (Think too of the Lottery Paradox, which pivots on the consideration that an event that is *certain* can be disjunctively constituted of events of extremely low probability.)

Then too, there is the crucial fact that no matter how great a probability (short of 1) we incline to demand for acceptance, we are forced in the end to accept improbabilities, given that we cannot but accept the *conjunctions* of accepted theses as well. To be sure, these conjunctive difficulties can be averted by our becoming *holistic* probabilists. For if we apply a probabilistic acceptance criterion not to *individual* theses (or belief candidates) but to *entire systems* thereof – for example, all that are relevant to a given topic – the problem is averted. (A high-probability complex must have high probability components.) Yet to take this line is to preserve the program at the cost of making it unworkable in rendering its actual implementation too cumbersome for practicability. In real life we simply cannot operate with synoptic probabilities, but have to transact our probabilistic deliberations with issues of smaller scale.

Probabilistic epistemology is open to a still more fundamental objection. The globally probabilist epistemologist holds that propositional acceptance in factual matters *always* rests on a probabilistic basis, that rational acceptance of nonprobabilistic contentions is *always and everywhere* the product of probabilistic considerations. In consequence, the probabilistic program in epistemology faces the massive obstacle of the question: Where are those initial probability evaluations that are to

provide the whole basis of the epistemic project themselves to come from?

Clearly if it were the case that *all* rational acceptance, that of probabilistic claims themselves included, had to proceed from probabilistic claims – if probabilities could only be legitimately extracted from preestablished probabilities – then the whole venture could not get off the ground. To circumvent this obvious difficulty, probabilistic epistemologists propose to exempt one special category of theses from their precept that rational acceptance is always based on pregiven probabilities – namely the so-called "prior" probability claims, or "priors" for short. Factual claims of this particular sort, so they maintain, need not be grounded or evidentiated at all – they are simply somehow "given" (or "taken"). They are (and must be) theses which involve no preestablished acceptance at all, but are mere subjectively stipulated posits – decrees that stake claims (of a specifically probabilistic nature) which subsist without themselves having any visible means of support in the realm of acceptance.

And just here is where the whole program runs into deep difficulty.

Clearly, if those priors are to be cognitively useful to anyone, they *must* rest on an informational background of some sort – some analogy to other preestablished cases, or the like. Even if one is to invoke the principle of indifference, some input-information will be needed. "There are only two possibilities here, so, knowing nothing further, I'll estimate them at 50:50". Fine! But then you take "There are only two possibilities here" as a preestablished fact.

We cannot in general set probabilities up as *universal* arbiters of facticity, seeing that they themselves must (if usable at all) emerge from factual considerations. Probabilities, in sum, are rather clients than masters of evidential reasoning.

The point is simple. If those prior probabilities are to play a cognitively appropriate role, they must themselves be validated or justified evidentially in a way that requires preestablished factual inputs. The long and short of it is that if those priors are to enable us to do any rationally useful work, they cannot be synthesized *ex nihilo*.

The probabilistic epistemologist is thus caught in a vitiating dilemma. The only sort of acceptance that a global probabilism is prepared to exempt from a dependence on other preestablished probabilities is the acceptance of certain *probabilistic* claims. And yet no rationally appro-

priate probability claims can be secured without recourse to those matters of nonprobabilistic fact needed for their specification. One cannot even begin to ask about the probability of getting "heads" on a toss of a coin until one is prepared to presuppose a good many things about the object in question (for example, that it indeed *is* a coin). Well-defined probabilities can only be defined in the setting of established factual preconditions.

And nothing is solved by calling those prior probabilities "subjective". Even merely subjective estimates require preaccepted facts for their substantiation. "I estimate that the probability of its raining in London on an April day is .1". If you pre-accept nothing (e.g. that the London at issue is the city in England rather than the town in Ontario, Canada) and claim nothing (e.g. about how to determine whether a given day falls into April or not) then your "estimate" is cognitively pointless. However arrived at, if they lack any and all basis in what is accepted, those "priors probabilities" are useless for cognitive purposes. The considerations that define concrete probabilities (even our merely "subjective" or "personal" probabilities) must themselves be matters of nonprobabilistic fact. ("I estimate at one-half the probability that this coin will come up heads when tossed." Well and good. But it is clearly already established – or supposed – that there indeed *is* a coin at issue, and a normal one with a "head" and "tail".) The global probabilist is confronted with the insuperable difficulty of specifying the issues involved in probability claims without recourse to any nonprobabilistic commitments to define what those probabilistic contentions involve. He faces the insuperable difficulty of securing meaningful probability claims without any recourse to nonprobabilistic theses to define the probability issues. Those prior probabilities simply cannot achieve the impossible feat of being *entirely* preacceptance-avoiding and still cognitively productive. It is an inescapable circumstance that evidentially useable estimates of probability always involve prejudgments of nonprobabilistic facts. Facts are needed for any justified reliance on probabilities.

Perhaps there might be hope for a globally probabilistic program if one could establish that we humans possess a "sixth sense" of sorts to give us fairly reliable intuitive access to a realm of probabilistic fact – access that is direct and not discursively grounded in factual presuppositions. But this is a very problematic epistemological doctrine – and one of an emphatically factual (i.e., unprobabilistic) content. Moreover, on

all empirical indications, people do much worse in the "intuitive" handling of probabilities than in their intuitive handling of overtly factual claims. Recent experimental psychology throws considerable doubt on the idea that people's intuitive judgments in probabilistic matters are particularly trustworthy.

A salient point emerges: if it is to be *rational* acceptance that is at issue, then, clearly, the probabilities one proposes to deploy have to rest on some sort of sensible grounding. Whenever those prior probabilities are wholly baseless – the product of wild guesswork or mere supposition or unfounded hunches – then the whole business is pointless. Sensible results do not emerge *ex nihilo*. Garbage in, garbage out.

Probabilistic considerations may well be – nay doubtless are – an important *part* of an epistemological program. But they cannot be its one and only resource, as a global probabilism would have it.

CHAPTER SEVEN

THE THREEFOLD WAY

1. THE THREE LEVELS

This essay is a study in the phenomenology of *conception* as distinguished from the more familiar phenomenology of *perception*. Its concern is with a particular resource of our cognitive strategy – one conceptual instrumentality for thinking about the nature of things. It investigates the idea that in contemplating the various aspects of the world's arrangements, one can operate at three distinct "levels of consideration": the levels of *immediacy*, *proximity*, and *totality* – of what is immediately at hand here and now, of what stands in the nearer offing at only a modest distance, and of what lies in the more distant and "visionary" reaches of an all-encompassing whole. Figure 1 illustrates the standpoint of this distinction,

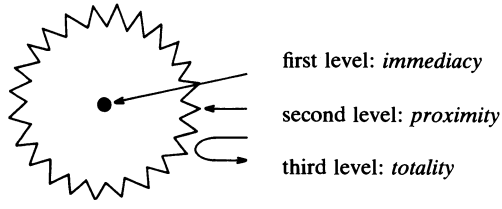

Fig. 1. Three levels of consideration.

depicting the tripartite division of what is at hand, what is conveniently accessible, and what lies (even if remotely) within the overall domain of relevant reality. The three domains thus represent the immediate position, the local neighborhood, and the holistically, all-inclusive global environment.

This distinction of levels of consideration bears upon an enormously vast and diversified range of instances in common-life deliberation and philosophical reflection alike. Some illustrations of this three-level perspective are:

spatial:	(here/near/somewhere)
temporal:	(now/soon/sometime)
personal:	(I/we meaning "those of us present"/everyone)
social:	(oneself/one's group, clan, community, or nation/humanity, mankind)
availability:	(at hand/in prospect/attainable in principle)
significance:	(local/regional/global)
compositional:	(individual constituent/complex component/all-encompassing whole).

The same basic three factors are at work in this tripartite schema of placement:

(1) *The reference point*: What is the "immediately present" focal point at issue? Frequently it is something self-referentially relativized to the speaker's position in the scheme of things (here, now, oneself). But sometimes it is simply a fixed point of reference – an objectively specified item.

(2) *The dimension of distancing*: How does the remove at issue operate – is it with respect to space or time or feasibility or causal relationship or genealogical connection or "social distance" or what?

(3) *The scale of measurement*: How near is near; just how far does the region of "proximity" extend? For example, in the temporal case of (present/near future/remote future) we shall have such variants as:

(today/the next few days/sometime)

(in our lifetime/in the lifetime of people we know [friends, children, grandchildren]/in remote times).

Throughout, it is the same general idea of placement ("here/near/somewhere") that is at work. But while uniform in their basic tendency, the three levels are something context-variable that can be applied in an almost endless variety of ways.

2. SOME EXAMPLES

The conception of threefold levels comes into play with any and every sort of increasing range of concern or scope of inclusiveness:

(immediate unit/environing items/correlative totality)
(particular instance/general class/all-inclusive whole)
(ourselves/our progeny/our posterity at large)
(particular component/local context/entire system)
(organ [heart]/system [circulatory system]/organism as a whole).

In all such triads we find an increased expansiveness of purview, an ongoing enlargement of what is taken into account. The sort of "distance" at issue – how we propose to understand the connection that links the items to that fixed reference point – can of course vary enormously. The mode of distance at issue may be literal, or else very figurative, as, for example, in the case of "closeness of depiction" as with the trichotomy:

(*totally indistinguishable* [alike in all respects, though numerically distinct]/*closely similar* [alike in many respects]/ *remotely resembling* [alike in some respects]).

Some further illustrations of this three-tier division are reflected in placement in:

a theater: center-stage, on-stage, off stage;
a picture: foreground, background, "surround" (what lies "beyond the canvas");
a novel: the protagonist, the main characters, the cast of characters at large.

The case of the picture is particularly interesting. The picture has three aspects: what we are invited to focus on, what we can actually see as a part of what is presented, and what we can "see" only with the mind's eye. Note that this larger "invisible" context is always something effectively "present" in some vague way – we would be shocked if a larger metapicture emplaced our picture within a totally "incongruous" setting.

Still further illustrations are afforded by cases of proximity in terms of social status or political power to the "top man":

(the president/the cabinet/the government at large);
(the king/the aristocracy/the people).

Different levels of consideration can also operate with respect to responsibility in the context of the scheme (self/proximate individuals/all

[relevant] individuals), as reflected in the purviews of differently situated individuals:

> (the commanding general/the unit commander/the individual soldier);
> (the big boss/the management/the employee).

The journalistic categories of *local*, *national*, and *global* afford a further illustration. Generally, the standards of assessment that we use – standards of personal wealth, political power, sporting prowess, etc. – can operate at all three of these levels of local community, regional group (state, nation), and world at large. For example, we have the local champion of school or club or town, the state (or regional or national) champion, and the "world class" player of Olympic standards. Such a trichotomy also underlies the distinction between:

- the *amateur* whose concern is merely to achieve adequacy on his own reckoning;
- the *professional* who is concerned to achieve recognized competency by generally acknowledged standards;
- the *expert* or *past master* or *virtuoso* who performs at a level altogether above and beyond the ordinary range of expectations, and attain results whose excellence would be recognized universally – even by the most demanding.

The levels ot *adequacy*, *competence*, and *excellence* accordingly represent a further instance of the threefold way of consideration.

Again, consider a grammatical example – the comparison of adjectives:

absolute:	by itself (as a single item) – large;
comparative:	compared with certain others (in relation to a limited comparison group) – larger;
superlative:	compared with everything of its kind (in relation to an unlimited, all-inclusive comparison group) – largest.

Still more elaborate illustrations are:

> (on first view/on closer examination/with everything taken into account, "in the final analysis");

(idiosyncratic habit or local regularity/general pattern or regional regularity)/general law or universal regularity);
("I think" or my subjective *belief*/"we think" or our interpersonal *opinion*/"to be thought (impersonally)" or *knowledge*.)

The traditional threefold philosophical classification of the kinds or grades or levels of knowledge depicted in Table I cashes out this last trichotomy – along the axis of the range of cases for which the sort of "knowledge" at issue can safely be assumed to hold, leading to the three levels of anecdotal, empirical, and scientific generalization. The three Aristotelian realms (mundane, sublunary, celestial) also exemplify our tripartite hierarchy.[1]

TABLE I
The traditional trichotomy of knowledge

	Clement of Alexandria	Nicholas of Cusa	Spinoza	Kant
The Observer: *sensation* (particular observation: *these* cases)	*pistis*	*sensus*	grade 1	*Sinnlichkeit*
The Empiric: *understanding* (general rule: *many or most* cases)	*gnosis*	*ratio*	grade 2	*Verstand*
The Scientist: *reason* (universal law: *all* cases)	*epistémé*	*intellectus*	grade 3	*Vernunft*

Source: H. A. Wolfson, *The Philosophy of Spinoza*, Vol. II Cambridge, Ma., 1934, pp. 133 ff.

3. MAN AS A CREATURE OF THE THREEFOLD WAY

A further illustration of our tripartite perspective is afforded by grammatical variation in the dimension of immediacy or prospectivity:

present: what is so – "he comes, so let us. . ."
future: what is to be so – "when he comes, let us. . ."
subjunctive: what might be so – "should he come, let us. . ."

Man's involvement ("*engagement*") in the world's scheme of things operates at all three of these levels of increasing "remoteness": the actual present, the foreseeable future, and the realm of mere possibility. We function at these levels by way of:

doing	–	current involvement in activities here-and-now;
intending	–	planning projects for action in the (near or foreseeable) future;
contingency planning	–	providing for contingencies inherent in alternative possible futures.

Proceeding along these lines, we arrive at the three levels of *the actual* (what is real here and now), *the probable* (what can safely be anticipated), and *the possible* (what can be imagined). Lower animals operate only at the first level, through an automatic response to actually present stimuli. Higher animals also operate at the second: they can act with some degree of foresight to make provision for the future. But man alone, it seems, contemplates mere possibilities and operates at the level of creative imagination.

A further example of this outreach beyond the range of immediate accessibility is our preoccupation with our fellow man, which cuts across all three levels in the dimension of "psychic proximity":

- concern for self;
- concern for biological or functional relations (one's family and associates and friends – the near and dear);
- concern for others (people at large – one's fellow man).

A reasonable *balance* among these domains of concern is essential to a fully human existence – to confine oneself to some at the expense of utter neglect of the others is a departure from sensible norms, an "abnormality" amounting to a mania of sorts. As such examples indicate, our self-image as human beings calls for so thinking of our place in the scheme of things that we position any sort of immediacy within a wider overarching framework of global totality.

Outreach beyond our immediate neighborhood is a characteristic

feature of the human condition. Characteristically, man is a creature who cares for what goes on remotely, for whom it is right and proper to "take the large view", and who expends *some* thought, concern, effort, and energy on the third level of consideration. Indeed most ethical systems pivot on just this fact in their universalized concern for one's fellow man in general (the Kantian emphasis on universalizability or the utilitarian standard of "the greatest good of the greatest number" are clear instances). Civilized man, *Homo sapiens socialis*, has evolved into a creature destined to spend some time and effort caring about the third level – a type of being who is uniquely a creature of the *threefold* way.

4. THE QUESTION OF LEGITIMACY: THE UTILITY OF THE IDEAL

Deliberations at the level of totality generally involve us in idealization – in reflections regarding how things stand when we drive matters through to their logical conclusion. Experience is always particular and parochial – always subject to localizing conditions. Our one and only access to the experience-transcending completeness and totality at issue with the third level of consideration is by the use of an imaginative extrapolation beyond the limits of securely attained experience. Accordingly, philosophical theoreticians of rigidly empiricist inclinations have always mistrusted the third level. With Sextus Empiricus, Hume, and Kant, they preferred the sphere of the immediate and proximate – what lies securely at hand or within reach. They distrusted the third level of deliberation because this sphere of global totality has something ultramundane about it – something "unrealistic" and impracticable.

Immanuel Kant affords a clear example of this perspective. Experience alone, he tells us, can afford secure knowledge of the real. And of necessity experience deals in particularities; totalities lie outside its domain. With such idealizations we literally cannot come to "*know* what we are talking about":

> [I]deals are transcendent and overstep the limits of all experience; no object adequate to. . .[them] can ever be found within experience. If I speak of an idea, then as regards its object, viewed as an object of pure understanding, I am saying a *great deal*, but as regards its relation to the subject, that is, in respect of its actuality under empirical conditions, I am for the same reason saying very little, in that, as being the concept of maximum, it can never be correspondingly given *in concreto*. Since in the. . . [cognitive] employment of reason the latter [namely, knowledge under empirical conditions] is indeed our whole purpose. . . we say of such a concept that it is *only* an idea.[2]

For Kant, the entire level of totality is "off limits" to human knowledge in the empirical domain because it lies outside the range where secure information can ever be achieved by experiential means.[3] (To be sure, Kant ameliorates matters by allowing practical reason to operate at the third level.)

Any rejection of level three fails to acknowledge that our standard concept-scheme is irrevocably committed to a global perspective. In viewing the world we humans invariably also use a mind's eye vision that looks beyond what the body's eye can possibly see. Abandonment of the third level does not do justice to the fact that the plane of totality is not just the natural habitat of philosophical deliberation (which certainly indulges our tendency to push ideas to the limit – to consider what they commit us to "in the final analysis" and where they "ultimately" lead), but also provides an indispensable thought-resource in whose terms we consider the issues of everyday life. "Someplace" figures as crucially in our thinking as "here-at-hand", "sometime" as "at this instant", "someone" as significantly as "one of us here". We standardly so frame our thought as to project its ramifications beyond the secure realm of accomplished facts and insist in locating local issues in a global framework. The trichotomy:

(available/attainable/ideal)

reflects the threefold classification:

- in hand: real or actual;
- reachable by effort: realistically attainable;
- beyond our reach: attainable "in theory only" (utopian).

That third level of consideration at issue with totality/universality takes us beyond the range of the practicably realizable. It takes us beyond experience into the realm of *imagination* – outside of what we do find, or expect to find here in this real world, into the region of wishful thinking, of utopian aspiration, of what we would fain have if only (alas!) we could. Admittedly this envisions a perfection or completion that not only outreaches what we actually have attained, but what we can possibly attain in this sublunary dispensation. But to give this up, to cease casting those periodic wistful glances in this "transcendental" direction, is to cease to be fully, genuinely and authentically human. In following empiricists and positivists by fencing the third level of deliber-

ation off behind NO ENTRY signs, we diminish the horizons of human thought to its grave impoverishment. As is readily illustrated by examples from Galileo and Einstein, there is a valid place for thought-experiments that involve idealization even in the domain of the natural sciences themselves.

Deliberation at the level of totality is a most useful, indeed essential, resource because the proper appraisal of realities is greatly aided by use of such idealizations. Be it in appraising our own activities or in evaluating the world's arrangements, our understanding of what is actually at hand, the proximate, is standardly shaped by our sense of its emplacement within the remote. We appraise what *has been* done in terms of what *might be* done and judge what is present in relation to what is absent. We orient the nearby in its relation to the distant, and invariably have a better and clearer idea about where we in fact are when we locate it in relation to its larger environment.

The idealized level of comprehensive totality thus provides a most valuable conceptual instrument. For it provides a most useful *contrast conception* that serves to shape and condition our thought. Like the functionary in the days of imperial Rome who stood at the emperor's side to whisper intimations of mortality into his ears, so the idealizations of the third, synoptic level of consideration serve to remind us of the fragmentary, incomplete, and parochial nature of what we obtain at the first two levels. If the third level was not there for purposes of contrast, we would constantly be in danger of ascribing to the parochially proximate a degree of completeness or adequacy to which it has no just claims.

The threefold way is not only imprinted indelibly on our language and our ways of thought, but is also deeply rooted in the cognitive circumstances of the human condition. To prohibit our thought from operating at the idealized level of a global inclusiveness that transcends the reach of actual experience would create a profound impoverishment of our intellectual resources. In thus clipping our wings, it would transform us into creatures of a twofold way. And this would produce a profound distortion of the intellectual situation. To realize the full range of our potential – to be true to the full spectrum of our definitive talents and capabilities – we must also function on this third transcendental level. To block off our entry into the sphere of all-embracing totality represented by the third level of consideration is to cut us off from a domain

of thought that characterizes us as the intellectually amphibious creatures we are – as beings able to operate in the realm of realities and of ideals as well.

The third level of deliberation thus reflects aspects of the human condition that cry out to be described in theological terms. Expelled from the Garden of Eden, we are cut off from the whole sphere of completeness, perfection, comprehensiveness, and totality. We are constrained to make do with the flawed fragments of a mundane and imperfect world. But we aspire to more. Beset by a "divine discontent", we yearn for that unfettered completeness and perfection which (as empiricists rightly emphasize) the realities of our cognitive situation cannot actually afford us.

The impetus to absolute totality – to unrestricted completeness – reflects an important and characteristic facet of the species. It marks us as a creature of the threefold way – a creature that sees itself as reaching out from any secured position not only to what is proximate enough to be attainable, but also towards that which lies altogether beyond our reach. Not content with graspable satisfactions, we seek for ever more and press outwards "beyond the limits of the possible". It is a characteristic *and worthy* feature of man to let his thought reach out towards a greater completeness and comprehensiveness than anything actually available within the mundane sphere of secured experience. Our inclination towards the third level manifests our refusal to wear blinders that keep the proximate from projecting towards an unreachable completeness.

Homo sapiens alone among earthly creatures is a being able and (occasionally) willing to work towards the realization of a condition of things that does not and perhaps even cannot exist – a state of affairs where values are fully and comprehensively embodied. Our commitment to that third level of absolute totality makes us into a creature that is something more than a rational animal – a creature that strives towards the achievement of something that it cannot attain save by the mind's eye, because such attainment calls for a greater perfection and completeness than the recalcitrant conditions of this world allow to be actualized.

CHAPTER EIGHT

NUMBER IDOLATRY AND FALLACIES OF QUANTIFICATION

These deliberations will consider four widely current "Fallacies of Quantification" and their implications.

The first of these fallacies is that of the thesis:

What one cannot quantify is not important.

The American mania for numbers is notorious. For us, numbers have become a latter-day Baconian "idol of the tribe". We love to rate and the rank – everything from the world's best tennis player (even though performance varies substantially with playing surface) to the world's favorite soft drink or airline company. We worship at the altar of statistics: the thirst for measurements and quantities is a salient characteristic of our culture. Living in a society and in an era that is bedazzled by quantification, we have become *Homo numerans*, quantifying man. The splendid successes of natural science have enticed even the least numerate of us to the tempting idea that measurement and quantification afford the only true pathway to genuine understanding. Modern bureaucracy's commerce in paperwork and reports is just one more illustration of a dedication to statistics – not necessarily with a view to any pressing particular need, but nowadays often seemingly for their own sake.

It is this idolatry of numbers that underlies the great characteristic delusion of the times represented by the aforementioned fallacy. A laudable impetus to quantify the things that are important tempts us into the folly of deeming the things we cannot quantify to be negligible.

Testifying before the Presidential Inquiry Commission on the explosion of the shuttle *Challenger*, the representatives of Morton Thiokol, the contractor that produced the booster rockets, explained their frustrations in persuading their NASA counterparts that it was unsafe to launch in the low temperature conditions of the morning of January 26, 1986. Thiokol's representative felt that "we had to prove to them (NASA) that we weren't ready to fly". And this was difficult to do because, when it came to the effect of cold on the seals that were at the heart of the problem, "I recognized that it's very difficult to quite

quantify at which temperature these seals may be acceptable and at which they aren't acceptable. Now based on that data – some of it certainly was inconclusive – there was no doubt in my mind. And that's a difficult thing to quantify. . . ."[1] Given this circumstance, NASA refused to be convinced. There was little doubt in the mind of this witness that some shortcomings of quantifiability led to the discounting of his data.

This approach is, quite clearly, the height of folly. "What you can't quantify doesn't matter" is about as silly a thesis as "What you don't see can't hurt you". This "Quantification Fallacy" is just that – a fallacy. That night's debate in Florida between Thiokol and NASA puts before us a vivid and terrible illustration of the Quantification Fallacy at work.

The converse of the present fallacy, the idea that *whatever can be quantified is therefore important* also has its problems. It too is clearly a fallacy, given the wide scope there is for quantitative trivia. But it is easy to fool ourselves into thinking that the things we can readily measure are the ones that count.

Numbers do not always tell the story. The wise strategist realizes that God is not always on the side of the big battalions. "How many divisions has the Pope?" Stalin asked. It is not a question that bemuses General Jaruzelsky in Poland. By all quantitative yardsticks the U.S. was ahead throughout the Viet Nam conflict and duly won the battles – but lost the war. The numbers just do not always reflect conveniently the impact things will eventually exert upon the world's course. In complex situations, the quantitative factors may be the easiest to get hold of, but they are not necessarily the most pivotal. Certainties are more easily measured than uncertainties, simplicities than complexities. But they are not necessarily the determining factors.

Our sense of legitimacy no longer relies on perceived quality or reputation, but demands validation through numerical rating-indices. We demand quantitative performance ratings for our products, livability ratings for our cities, and quality indices for our schools. We rank colleges not on the competence of their graduates but in terms of "quality point averages" and their scores on "objective" examinations. With tennis players performance on the courts is not an end in itself but a mere means to good computer rankings.

Time and again we need to be reminded of the importance of a concern for the things we cannot quantify – or cannot yet quantify in the existing state of information. Public opinion polls or the statistical

content analysis of newspaper articles in the local press may have provided "hard data", but certainly were of little help to someone trying to judge how well entrenched or vulnerable the position of the Shah was in Iran. To judge by the coverage of social issues in the media, thoughtful policy debate is impossible without a reliance on statistics. Common sense and historical analogy count for little. And yet numbers too can speak with a forked tonque. (Extrapolation is a dangerous sport; be it with hemlines or employment statistics, a one percent shift this year seldom presages a ten percent shift a decade further on.)

We forget all too easily that there are "lies, damned lies, and statistics", as Benjamin Disraeli put it. The numbers are not a substitute for sound judgment. On the contrary, it is generally only on the basis of sound judgment that they themselves are useful. Admittedly, the sensible appraisal of situations is often encouraged and facilitated by numerical data. But statistics only carry a meaningful message to the prepared mind.

There is no need to deny that plain fact that quantitative information is often illuminating and useful. The point, rather, is that there is no earthly reason to think some sort of correlation exists between the ease and accuracy of the quantifiability of some consideration and the significance of its role in the matters to which it relates. The remedy of the fallacy at issue lies in recognizing that: *the things you cannot quantify in the context of an inquiry may well turn out to be the most important.* As long as we persist in adhering to the Quantification Fallacy by thinking that what one cannot qualify just is not important and can safely be ignored, we shall also persist in trying to send aloft rockets, economic policies and social programs that just will not fly.

Let us now turn to our second fallacy, which is clearly related the preceding one:

Everything (at any rate everything that is even remotely interesting) can be quantified.

Fallacy No. 1 maintained that whatever is important can be quantified; the present fallacy says that whatever is really interesting can be.

A good illustration of this fallacy is provided by the IQ tester's idea of a pervasive "intelligence." How intellectually able people are is generally of great interest to us. Clearly, people have very different levels of ability – be it bodily or mental. But there is no good reason to expect that someone's physical or intellectual dexterity or versatility can be

represented by a single number. And the fact that it would be *convenient* if this was so from the angle of our educational or managerial programs just does not make it true. Even a student's performance on one of those objective tests on which we Americans place so much weight in college admissions processing, or National Merit Scholarship awards, indicates little about real ability for academic work or for doing anything substantially different from taking objective tests.

Rational choice among alternatives is undoubtedly a matter of selecting "the best option." But since this preferability cannot in general be quantified in most real-world situations, its comparative determination is a matter of *qualitative judgment* rather that *quantitative measurement*. The appraisal at issue is generally not a matter of quantitative evaluation but of comparison and contrast with other cases – of analogy and assimilation. The experienced judge often *evaluates* but seldom *calculates*.

In many of our deliberations we do well to adopt this judicial model of decision-making rather than that of quantitative comparison – not a model of calculating but of appraising by "weighing arguments". And the idea of "strength of evidence" is an example of a situation in which quantitative resources leave us in the lurch. The crux is not a matter of scientific computation but of informal estimation – of making "judgment calls" on the basis of seasoned experience that may not have a quantitative foundation. We generally cannot assess the bearing of evidence in quantitative terms.

The crucial lesson is that even where quantification is impracticable – or even though in principle feasible where numerical data are lacking – it is perfectly appropriate to place reliance on informed and tested judgment. There are situations in ordinary life, in engineering, and even in science, where we would do well to put our trust not in such shaky numbers as can be had, but in the informed estimates of experienced and knowledgeable minds. In the cognitive and practical affairs of man there are all sorts of issues where quantification is infeasible and we must proceed by qualitative judgment based on assimilation and analogy.

To avert the fallacy at issue we must accordingly recognize that, despite what people may think to the contrary, *some highly significant and interesting matters simply cannot be quantified*.

Now we come to yet another of our quantificational fallacies:

Quantification and measurement are one and the same.

This thesis is also emphatically incorrect. The fact is that quantities may not be descriptively meaningful at all. Numbers need not *measure* anything; not everything quantitative is a measure. "How many of those girls remind you of your mother?" you ask me. "Two", I respond. A lovely quantity, that! But what in heaven's name am I *measuring*? Quantification is not necessarily measurement.

Science has succeeded in mathematicizing the realm of our knowledge to such an extent that we tend to lose sight of the fact that the realm of our *experience* is not always all that congenial to measurement. It is full of colors, odors, and tastes, of likes and dislikes, apprehensions and expectations, loves and hates that allow precious little room for measurement. We readily forget how very special a situation measurability is – even in contexts of seeming precision.

To measure (in any appropriate sense of the term) is to affix a numerical yardstick to some quantitative *parameter* that has its own foothold in the world's scheme of things – length, temperature, money-circulation or the like, an objective and well-defined aspect of the make-up of things in "the real world". Measurements reflect those particular descriptive features of things that can be reflected in quantitative terms. And when quantities fail to capture such descriptive features, they just do not *measure* anything.

An important conclusion emerges. Quantities may not measure anything at all. It is by no means the case that every quantity we can specify is a measure of some well-defined and pre-existing parameter in the natural or social realm.

Consideration of the preceding fallacy leads naturally towards the recognition of another.

The quantities that measure various distinct factors can always be combined in a meaningful aggregate. They can ultimately be seen as exchangeable parts of a composite whole.

This idea that different sorts of quantities can be lumped together as convertible constituents of one single composite – that they can be seen as exchangeable parts of an aggregate whole – runs deep in modern thought. All the same, it is highly unrealistic. Consider, for example, some of the points of merit that relate to the effectiveness of a car:

- maximum speed;
- starting reliability;
- operating reliability (freedom from breakdown);
- passenger safety;
- economy of operation.

If the top speed of a car is 5 m.p.h., no augmentation in passenger safety or operating reliability can make up for this shortcoming. Again, if the car is eminently unsafe, an increase in its other virtues cannot offset this. Where the various merits of a car are concerned, there simply is no free exchange among the relevant value-parameters, but only complicated (non-linear) trade-offs over a limited range. And this illustrates a general situation.

In general, things have many different value-aspects and we have no workable single-valued "function of combination" enabling us to extract a single, all-embracing *measure* of overall value from them. We have to deal with a plurality of distinct "parameters of value". Even if we assume (perhaps rashly) that measurability is possible *within* each of these parametric dimensions, there is generally no way of making quantitative exchanges across different value parameters by way of weighing them off against each other in a common scale. The elements of a good journey are not commensurable: adding more spectacular scenery cannot make up for bad food. (Adding more salt, no matter how much, will not compensate for a cake's lack of sugar.) We can readily quantify various features of urban life – crime rates, housing costs, park acreage per capita, and so on. But does that mean we can combine such numbers into one single meaningful index of quality-of-life?

To think (as per the economists' "utility") of assessing the preferability of goods by a single number is every bit as sensible (or foolish) as to think that we can reflect the intelligence of people in a single number – or even the value of a human life. What is going on throughout is an indulgence in number idolatry that rides roughshod over important differences and diversities.

The commitment to convertibility at issue in the economists' "utility" represents a harmless fiction in its proper sphere of tradeable goods whose value can be established in a common unit via a market exchange mechanism. But to pretend to have a more general and pervasive instrument for the rational governance of human decisions is skating on very thin ice.

"The good" at large is something multi-dimensional and not homogeneous. Enhancing it is a matter of optimizing a complex, not of maximizing a determinable quantity. The evaluative aspects of the goal are not interchangeable. We must harmonize rather than maximize. In general, when we have to appraise a profile or complex of desiderata, preferability becomes a matter of a contextually determined *structural harmonization* rather than of mensurational maximization.

We come thus to the need for recognizing that even when we are dealing with quantities that express meaningful measurements, the commensurability needed for an integrated measurement to result may not be possible. In many situations we may have to settle for quality-appreciative judgment where quantity-oriented measurement is simply infeasible.

Our Cook's Tour of quantificational fallacies is now complete. They represent principles of thought so deeply entrenched in our culture that it will seem to many to be problematic and tendentious even to suggest that they may be fallacious. The hue and cry is audible in advance: "Only though quantification and measurement are we put on the high-road of a scientifically valid understanding of how things work in the world". But think – is it really so? Where is it written that quantification alone yields genuine understanding – that judgment based on analogy or qualitative harmonization is unhelpful and uninformative, so that where numbers cannot enter, intelligibility flies away. Even to raise these questions is to be led towards a recognition that the idolatry of numbers is a prejudice or preconception that is not only questionable but potentially badly misleading. In everyday life, professional activity, and public affairs alike, reliance on numbers is no substitute for reflective thought.

CHAPTER NINE

LIFE'S SEASONS: THE CONCEPTUAL PHENOMENOLOGY OF AGE-PERIODIZATION

1. THE GENERAL IDEA OF A LIFE CYCLE

A young girl does not normally and naturally say to herself: "I am a teenager". An elderly individual does not incline to say of himself: "I am an old man". (At any rate, a recent study indicates that the percentage of white Americans who consider themselves to be old stands at only around 10 at age 65, and is still only around 30 at age 70.[1]) We do not tend to think of ourselves or of others who are particularly near and dear to us in such age-classificatory terms. Rather, we think of people close to us as *individuals* playing certain age-unaffected functional roles ("my mother", "my wife", "my child") and as possessed of certain perduring characteristics, abilities and dispositions.

Generally, we deem ourselves and those near to us as too special to stand in need of classification in such matters as age or social class or intelligence or personality-type. Instead, we incline to look on ourselves as a very special case – as defining the reference point around which other cases are positioned. One of the most basic questions we ask in our encounters with other people is: "Is he/she older or younger than I am?" We see the crucial issue as being that of other people's relationship to ourselves. On this basis, an "old" person is not one who has attained a certain age, but one who is (say) 15 years older than oneself. (Seemingly, a receding horizon separates us from old age: to the young child, someone in his 20s is old; to the sixty year old it is someone above 75.)

Self-referential description has its limits, and especially so in circumstances where the self keeps changing. For communicative purposes – in writing or sending messages when we are not on the scene – we do not, nay cannot, let the matter rest there. Accordingly, no language lacks the age-classifying terminology of young and old, child and adult. Despite its banality, the terminology for classifying age has various interesting features that rarely are noticed. Let us consider some of them.

Human existence in this mortal sphere inexorably presents us with a

constantly changing situation. And the "outlook" of each successive age-category looks very different. Altered planning horizons come into play. Children "have their whole life before them" and incline to think that they will go on forever. The young live in a thought-world of unimpeded possibilities – as exemplified in teenage "day-dreaming". The middle-aged inhabit a world of action and activity (of "making their way in the world") and are attracted towards the *carpe diem* outlook characteristic of mid-life crises. The elderly approach the end of the tether of their potential. For them the exercise of control and the enjoyment of the fruits of power is – where available – a cardinal good. The very old tend to glance backwards and to direct their future-oriented arrangements towards the *après nous* of their posterity. The temporal transit through life's journey is associated with constantly changing views of prospects and possibilities.

These different outlooks indicate that we think of a lifetime not only as an extent of temporal duration, but also as a succession of definite stages. We view life not just in terms of a life *span* but of a life *cycle*. From hoary antiquity onwards, literary tradition sees this in terms of an analogy to the seasons of a year; analogizing childhood to spring, youth to summer, maturity to autumn, and old age to winter.

The medievals, habituated more to the diurnal ritual of the ecclesiastical day than to the agrarian cycle of the year, preferred a different analogy: the morning of childhood and youth, the mid-day of maturity, the evening of old age, and the coming of the eternal night where no man can work. This set a theme to which the "Book of Hours" gave endless variations.

When we contemplate the major descriptive classifications of people by such factors as race, sex, language/culture, and age, we come to realize that not only is a person's age the only one that is readily altered, but that alteration in this regard is actually inevitable. Everyone who is not prematurely carried off by death is involved in an inescapable transit through the successive stages of life.

The Romans viewed these stages in the sequence depicted in Table I. Such a periodization reflects a series of functional divisions according to capacities. The infant has not yet achieved the age of reason where rational suasion replaces peremptory command. Childhood ends at puberty, when one is physically and/or legally able to bear or father children. One then continues as a young adult until such time as one can

TABLE I
Roman age periodization

Nomenclature	Age (in years)	
(1) *infans* (infant)	0–7	(i.e., until the shedding of the "milk teeth")
(2) *puer or puella* (child)	7–12/14	(i.e., until "marriageable" age: 12 for females, 14 for males)
(3) *iuvenis or junior* (young person)	15–44	(the "prime of life") This falls into two phases separated by the threshhold of legal adulthood: – legally minor: 15–24 (too young to serve as a judge, *iudex*, or (lowest-ranked) magistrate, *quaestor*, or to enter into contracts) – legally adult: 25–44 (legal majority commences at 25)
(4) *senior* (elderly person)	45–59	
(5) *senex* (old person)	60 & beyond	

no longer effectively serve one's prime function, an "old man" being too old to fight effectively as a soldier, an "old woman" being too old to bear children.

The "flourishing-age" of classical antiquity, the *acme* or *floruit* (at roughly 40 years) stands as the peak of the period between birth and life's ultimate limit of around 80. The dictum that "life begins at 40" gets it exactly wrong. This age represents the "turning point" of one's human flourishing, after which we "go downhill". (Observe the hill-climbing analogy which, like that of the seasons, is also of the hoariest antiquity and has been the subject of a substantial iconography.)

When we compare this classical Roman periodization with the current American scheme, we find much greater complexity in our modern system of age-classification. Consider Table II. In comparison with the Roman system, note first the relatively recent contraction of infancy to the period of babyhood (in England, "infant schools" still go through to the age of seven). Another difference is the postponement of the start of adulthood from ca. 15 to ca. 18. The need for more education and training evidently serves to advance the age when adulthood begins. (In a post-industrial society based on the primacy of tasks that require substantial professional training, this increases even more.) Then too,

TABLE II
Contemporary age periodization

	(1) Babyhood (infancy)	0–2
	(2) Childhood	3–12
	(2a) pre-school age (pre-literacy)	3–5
	(2b) school age (literate)	6–12
	(3) Teen-agehood (adolescence)	13–18
	(4) Young adulthood	18–24
	(*Note*: legal majority commences for some purposes at 18, for others at 21)	
	(5) Mature adulthood	25–34
	(6) Middle age	35–59
	(6a) early middle years	35–44
	(6b) later middle years	45–59 ("past one's prime" for men, "post-menopause for women")
"senior citizens"	(7) The elderly	60 onwards (recently up from 50)
	(8) The old	70 onwards (recently up from 65)
	(9) The very old	80 onwards (recently up from 70)

note the postponement of old age from ca. 60 to ca. 70 with the general improvement in people's health. Moreover, the very old represent a relative innovation as a significant distinct category. In English we still lack a distinctive word (unlike German: *ein Greis*) to characterize these "survivors of their generation" not just as *old*, but as *very* old, as "(really) aged". ("Senile" will hardly do – senility is a matter of physical condition, namely physical and mental infirmity and loss of control, and not of age as such. Some writers use the awkward "old-old".[2])

2. THE RATIONALE OF HUMAN AGE-PERIODIZATION: PHASE TRANSITIONS

Age classification proceeds in terms of a series of developmental stages, demarcated by "phase-transitions" that represent "milestones" in human development: capacity for speech (around 1–2), capacity for reproduction or *biological* adulthood (around 10–13), capacity for self-management or *social* adulthood (around 18–21), onset of marked physical decline (around 55). These successive "milestones" represent phase transitions that constitute boundary crossings between the major

successive stages of life. They are "rites of passage", as it were, through which we move from one of life's phases to the next.

Note, however, the inherent variability of those phase-transition stages. In modern times the age of adulthood has been postponed. Functional adulthood tends to reflect social needs. It is one thing in a society dedicated to fighting and farming, and something different in advanced and professionalized societies. Moreover, as the life expectancy of those who reach adulthood increases, the age at which (in a statistical sense) "death should occur" is also postponed. In Biblical times it was considered to be seventy years ("three score and ten"), nowadays it is perhaps eighty. With the progress of nutrition, public health, preventive medicine, etc., it may someday be ninety and perhaps even one hundred.

3. THE DIVERSITY OF AGE

The previously noted considerations point towards the complexity at issue in age-periodization. Strictly speaking, there is not just one age scale but many. For there is not simply the chronological age represented by the length of a person's existence in "real time", but also various different modes of age as illustrated in Table III.

TABLE III
Different modes of "age"

(1)	Psychological age as determined by how old one "feels" oneself to be. (This is clearly a matter of health, attitude, and outlook. Some people are "old before their time.")
(2)	Social age as determined by social and especially familial role: marriage, children, grandchildren.
(3)	Physiological age as determined by bio-medical considerations.
(4)	Legal age: School starting, school ending; eligibility for drinking, driving, voting, military service; retirement and social security; and the like.
(5)	Cognitive age in the sequence that runs: novice, learner, competent practitioner, master.
(6)	Performance-oriented age: in tournament tennis one is old at 35; in one's prime in the mid-20s
(7)	Age in the service of an organization: "new fellow" vs. an "old timer" (who may be relatively young in years).

Psychological age is particularly interesting in its variability. It reflects the difference between subjective and objective in a manner analogous to the difference between phenomenal (or experienced) and real (or physical) time. The ideas that the "watched pot never boils", while, on

the other hand, "time flies when you are having fun", are familiar to us from our everyday experience. A similar story holds true for the difference between the person who is one of the world's hardy perennials and the person who has aged prematurely in the harsh school of bitter experience.

Performance-oriented age is chronologically variable in a different sort of way. Old for an athlete may be young for a philosopher. Functional adulthood arrives at 17–18 in a society of soldiers or farmers, but not until 25–30 in a society of scholars or highly-trained professionals.

Consider a periodization in terms of stages of competence along the lines sketched in Table IV, with three stages that mark the beginner, the adequate practitioner, and the master, respectively.

TABLE IV
Stages of competence

Stage 1	Effective start
	Achievement of competence
Stage 2	
	Achievement of mastery
Stage 3	
	Retirement

Some Instances

Craft	*Life*	*Military officer*	*Sport/game*
1, Apprentice	Childhood	Junior officer	Learner
2. Journeyman	Youth	Field officer	"Competent player"
3. Master	Maturity	Colonel and above	Expert

This line of thought also leads to the idea of a "career profile". And it also points towards the unwritten operational code of organizations. With the obvious exception of family-owned enterprises, one generally *introduces* people as new employees of a business firm or corporation in line with the schema:

- young adult (19–30): entry level;
- mature adult/middle aged (30–45): middle management;
- elderly (45–60): top management.

There is rather limited flexibility. One virtually never has an appointee get more than one age category out of step. Outside the sphere of

family-owned companies, it is almost unthinkable that a top management employee could be a "youngster". And it is comparably far-fetched that an entry-level employee would be "an older person". (Even though in an era of seventy-plus retirements a person of 40 has a functional future of some 30 years with the organization.) In an academic context, a full professor in his 20s or an assistant professor in his 50s would be seen as a major anomaly. Certain jobs are reserved for certain age groups. (Think of the old joke of the person who remarked that it must be very dangerous to deliver newspapers, and when asked why, responded by saying that this profession must have a very high mortality rate, since he had never seen a middle-aged newsboy.)

This general phenomenon is illustrated in the incumbency-pattern of major public and private sector offices at the highest level. The president of the US must, by law, be over 35 – but in practice is almost invariably over 45. The president of a university is almost always over 45. The American ambassador to a major European power is seldom under 50. The chief of staff of the US Army, the Chief of Naval Operations, and the justices of the Supreme Court are almost always over 55. The Roman virtue of *gravitas* (a mixture of "weight" and "seniority") is a near inescapable requisite of organizational power. Historically, in Western organizations, man has seen age as no less powerful a requisite for high-office than sex. (It is not an accident that the top dog in an organization is often called "the old man".)

Still, specific leadership roles apart, we tend to value age rather less than people used to do. In the West, at least, we do not venerate the aged – unlike the Orient. And for good reason. The primary advantage of age over youth is in the sphere of experiences. But experience is always experience of the past, and in a setting of constant change and innovation, the past tends to be irrelevant to the present. It is in primary situations of social stability that age is a resource of positive advantages because the teachings of experience have ongoing relevance.

In developed countries, law and public policy nowadays make for a sharper differentiation with regard to age than with regard to sex. The legal disabilities of minors (e.g. their disenfranchisement in the election process) or the special entitlements of the old (in matters of pension or access to social services) set the age groupings apart from any other sociological grouping by sex, race, religion, etc. Modern advanced societies treat age as a special factor whose bearing is more significant and far-reaching than any other. And yet there are problems here.

4. THE CONVENTIONALITY OF PHASE TRANSITION

It is a critical aspect of the present context that the phase transitions at work in an age periodization depend on people's *judgments of importance* – their assessment of "what really matters". Clearly, this is a fundamentally *evaluative* issue. We position phenomena in a classificatory and descriptive framework whose design involves judgments of importance and significance – value judgments in short.

Accordingly, an age-periodization scheme and the position assigned to people within its setting is not just a *descriptive* but also a *social* fact with respect to what people deem to be important. Age characterization is in substantial measure not merely a matter of what one is, but rather of how one is seen to be – of one's fit into a conventionally-established category. We are less "young" or "old" because of what we are or can do as individuals, than because people (ourselves doubtless included) think of our age group in a certain sort of way – since the society operates with an evaluatively based convention of classification that assigns to people a certain social status or category.

A person's chronological age – together with their capacities and capabilities – is doubtless a straightforward matter of objective fact. But one's characterization in terms of a descriptive periodization such as "a mere child", "a young woman", or "an old man", reflects a placement in a taxonomic framework whose divisions – those crucial phase transitions that separate one category from the next – issue from essentially evaluative judgments reflecting certain interests or concerns we ourselves bring upon the scene.

In roughing up the real world's smooth transitions, our age taxonomies also brush aside real-world details to suit the convenience of practical purposes in the context of our legal or administrative or everyday life concerns. They take the stance that the complexity of real-world detail can be discounted because it just isn't important enough to matter in the context of present purposes.

The law fixes a series of age milestones:

(1) Age of consent.
(2) Driving age.
(3) Drinking age.
(4) Voting age.
(5) Age of legal majority.

(6) Retirement age.
(7) Revocation age (e.g. for driver's or aircraft pilot's licenses).

All of these ages involve a legal fiction of sorts; all impose a sharp division on extremely variable phenomena.

Legal age-periodization is only *statistically* adequate. Its "hard-and-fast" boundaries make it into something very different from physiological age. In strictly chronological terms, the issues are highly variable. (Think, for example, of such bio-medical milestones as the ability to walk, the acquisition of speech, the loss of milk teeth, puberty, attaining one's full growth, etc.) And think too of the great variability of psychological aging, and the rejuvenating effect of new responsibilities and challenges exemplified by such names as MacArthur, DeGaulle Adenauer, or Reagan.

Any policy that treats people in terms of unidimensional age categories ("over 70") rather than in terms of natural groupings ("physically or mentally incapacitated") is inherently problematic. It bears the stigma of presumptive inadequacy – a presumption that can be defeated only through a substantial advantage in point of administrative economy, if at all.

Age-periodization is a matter of superimposing certain conventionalized judgments of importance on those fundamental objective facts about age and aging. Take the boundary between childhood and adulthood. Childhood is left behind when one begins to do what really matters, namely,

(1) To have children (ca. 13 years).
(2) To bear arms (ca. 15 years).
(3) To hold down a job or manage a household (ca. 18 years).
(4) To practice a skilled craft, say goldsmithing, or a technical profession – or, again, to play one's role in the realm of business affairs (ca. 21 years).

Different resolutions are made by different cultures in different circumstances. Once you settle that *those* are indeed the "milestones" – that they are what are important and significant – the rest is simply factual (descriptive and "purely informative"). But this fundamental issue of where the milestones fall is evaluative – reflecting a judgment about what "really matters" (is significant, interesting, germane to the fabric of our purposes). It is we, not nature's realities, that schedule rites of passage.

The periodization of age into successive phases is largely a matter of *social convention*. Actual physical age (in years, days, hours, minutes, etc.) is something that is (a) objective, and (b) informatively detailed (and thus, potentially, infinitely varied). That is just how the real world is – fine-grainedly detailed and thoroughly continuous. But the age characterizations used in our man-devised age taxonomies always involve artificial breaks and discontinuities. They reflect rules of thumb designed to render the variety and complexity of the real world amenable to our descriptive convenience. Accordingly they involve the elements of (a) subjectivity through the situation of phase transitions on the basis of values, and (b) roughness or vagueness to eliminate the variability of the real through oversimplification for the sake of operating convenience.

Accordingly, classifying someone in terms of an age-periodization is a step that superimposes certain value-judgments on the strictly objective age-related facts. If the facts stood as shown in Figure 1, periodization would be easy and "natural," but they generally stand as per Figure 2, and thus become problematic and artificial – constraining us to let "values" serve to differentiate when "facts" leave us in the lurch.

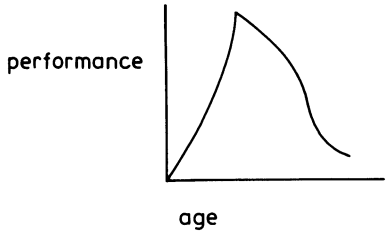

Fig. 1.

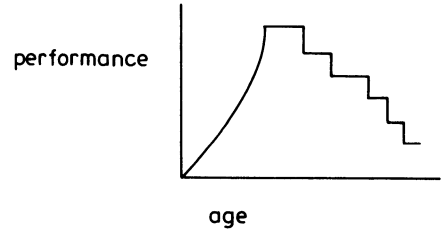

Fig. 2.

We must heed a crucial distinction when invoking values. The thing at issue is not the value of youth or old age *per se*. Whether one reveres the old or reviles them is beside the point. The crux is the prior issue of a differentiation between youth and middle age and old age, of our deciding that certain milestones – certain rites of passage – are so important in our understanding of what life is all about that they merit adoption as the boundary markers of an age-periodization scheme.

5. THOUGHT EXPERIMENTS

The attunement of age periodization to matters of evaluation is particularly

important when we engage in thought experimentation by projecting hypotheses that radically alter the character of the group whose values will be relevant. For example, consider the question of how this matter of age would appear if conditions were such that people had a life expectancy very different from the actual one – one of 20 years, say, or of 200.[3] We can consider in only the most speculative way how they would then revise our periodization of life. Their circumstances would change so radically that value changes would be bound to follow. And this involves a lot of specifics that mere hypotheses tend to leave out.

Very little is accomplished, for example, by the mere supposition that the half-life of human individuals increases from roughly 40 years to roughly 450 years. For one thing, we would have to know at what point in the life cycle those extra years appear. Are we dealing with a very prolonged infancy, where it takes 80 years to get people to where we presently have them at age two? Are we to look on them as aging to 80 at more or less the present rate, and then freezing into an interminable glacial period of decreptitude and decline. Or are they to gain all those extra years by taking 800 years to cover the period currently traversed in the decade from 40 to 50?

If the latter is the case, how tragic for the practitioners of child prodigy professions like tennis – or, if common report is right, creative theoretical mathematics or physics – where most contributors have their best work behind them by the age of 30 and are "over the hill" at 35. But how much worse for humanists – historians, say, or philosophers? What prospects are there for fledgling assistant professors, with a flourishing Leibniz on hand to put in another good 500 years of service and Kant as a mere lad with 600 years to go? Where will those classicists be on whom Bentley stole a march of 300 years, and who would have to labor for centuries under the censorious glance of von Wilamowitz-Moellendorf? Or what of the historians who would have to compete with a Leopold von Ranke who has a hundred years head start and yet has almost 800 years to go!

So the details will matter a lot. For example, how we would think about the role of age in a society of Methusalahs would clearly depend on the economic and professional structure of the society – on how important a role youthful vigor has in the requirements of the group. If preindustrial warfare were important for a society where only one per cent of the population was in fighting trim, "able bodiedness" would doubtless emerge as an important and respected factor.

6. THE UPSHOT

The moral of the story thus lies in the fundamental role of values. Despite appearances to the contrary, when you call someone young or old or middle-aged, you are not simply making a statement of fact, you are obliquely involved in statements of value as well. An age-periodization scheme is not just (not simply or merely) a *descriptive* mechanism. It reflects and embodies a commitment to cognitive values in the area of interest, significance and importance. For it is predicated on accepting the thesis that the *really important* (significant, crucial) phase transitions in the development of a human life are those that it encorporates. And, given the plausible principle that to *use* a scheme is to *endorse* it, we do, in characterizing someone in terms of such a scheme, *de facto* accept its underlying evaluations. Employing a given age-periodization scheme reflects a certain *ideology* – a way of looking at the world that reflects the "subjective" views of the onlooker as much as the objective nature of what he sees.

The philosophers of ancient Greece liked to pose the question of whether a certain fact obtained "by nature" (*phusei*) or merely "by (human) convention" (*nomei*). When someone is categorized by an age-classification such as "middle aged", we have little alternative but to hedge by saying that this obtains *by both*, seeing that the issue is one of human conventions superimposed on a natural state of affairs.

7. BROADER VISTAS

These deliberations about age-periodization accordingly open out upon broader vistas. For this process is significantly typical of a wide sector of the descriptive classifications used in the humanities and the human sciences. Throughout this humanistic domain, the descriptive classifications we employ effectively commit us to a position which, in its overall commitments and ramifications, is not *merely* descriptive, but also involves assessments of importance.

Unlike the taxonomies of physical and biological phenomena, the classifications we employ in characterizing the works of man (literary or artistic genres, stylistic periods or phases, methodologies and techniques, cultural or social artifacts) or those that we use in characterizing aspects of the human condition (not age alone, but economic status, social class, personality type, intelligence, talent, and performatory

competencies in general) always involve evaluation in exactly the manner illustrated by age-periodization. Such characterizations of their very nature involve an implicit reference to our values, and in doing so reflect the things that *intrigue* us because we have some sort of *stake* in them, thus invoking human "interests" in both senses of this term.

The classifications of natural science are designed to reflect substantial real differences in the objective nature of the object. We divide only where the demarcations are clear and sharp and general – where there are abrupt transitions in the phenomena themselves. In science we simply do not impose sharp divisions on continuities, setting up "artificial" boundaries (e.g. the distinction between "domestic" and "wild" animals) which reflect mere human interests rather than differences deeply imprinted on the operational character of nature's furniture. The classifications of natural science are designed only to facilitate the explanation of pre-existing differences and not to *introduce* differences by deploying our own interests to impose abrupt breaks where nature sees only gradual slides – reflecting the concerns and values that we ourselves import into the classificatory situation.

This matter of the value-ladenness of descriptive mechanisms of human interest is one factor which differentiates the humanistic "sciences" of man (*Geisteswissenschaften*) from the sciences of nature (*Naturwissenschaften*). It has major implications from a methodological point of view, reflecting the crucial circumstance that in the former (scientific) case our primary concern is with things as such, while in the latter (humanistic) it is with how people *think* about them.

These deliberations about life's seasons accordingly provide a useful case study in epistemology, because they clearly illustrate how the classificatory concepts employed in the humanities reflect a social relativity of evaluative judgment to a degree that is not matched in natural science.[4]

CHAPTER TEN

PHILOSOPHICAL TAXONOMY AS A PHILOSOPHICAL ISSUE

1. THE SHAPE OF PHILOSOPHY: SOME ANCIENT VIEWS

The history of thought about the shape of philosophy is itself a profitable subject for philosophical contemplation, partly because this history illuminates the development of the philosophical enterprise, and partly because it conveys some instructive lessons about its nature.

An early and enormously influential taxonomy of philosophy is represented by the organization given to the Aristotelian corpus by its Alexandrian editors. This taxonomy – depicted in Table I – established

TABLE I
The 'Aristotelian' configuration of philosophy

LOGIC: *instrumentalities of thought*
- terms: *theory of categories*
- propositions: *hermeneutics* (a logical grammar of sorts)
- syllogistic and "scientific" inference: *analytics*
- informal reasoning: *topics* (and *rhetoric*)

PHILOSOPHY OF NATURE: *the world's ways and means*
- philosophy of matter, be it inanimate (*physics*) or animate (*psychology*).
- metaphysics: philosophy of the immaterial or divine ("first philosophy")

ETHICS/POLITICS: *human action and interaction*
- the individual: *ethics* proper (moral philosophy)
- the group: *social and political philosophy*

Note: Aristotle himself never drew a map of philosophy. The source of this classification is the Aristotelian corpus itself, in the form given to it by its Alexandrian editors. Cicero accordingly tells us that the peripatetic system is generally divided into three parts, dealing with discourse, nature, and living, respectively, (*De finibus*, Bk. V, ch. iv, sect. 9.)

the traditional (and perfectly "natural" seeming) approach of classifying philosophical subdisciplines according to the nature of the *objects* at issue in the subject-matter orientation of the questions under consideration. It envisioned a tripartite partition of the subject, as the deliberations at issue relate to discourse, to nature, or to human agency. (No

TABLE II
The Stoic configuration of philosophy

LOGIC
- terms and propositions: *grammar/semantics*
- inferences: (propositional) *logic*

PHYSICS
- material objects (animate or otherwise): *physics* proper (including *psychology*)
- the gods: (seen as parts or aspects of material nature – its *tenos* or binding force): *theology*

ETHICS
- individuals: *ethics* proper

Source: P. P. Hallie, 'Stoicism', in *The Encyclopedia of Philosophy*, ed. by P. Edwards, Vol. 8 (New York and London, 1967), pp. 19–22.

separate place was allocated to theology in Greek antiquity because the divine was viewed as an aspect of nature – a force operative within it.) The Aristotelian scheme survives intact as late as Locke's *Essay*, where philosophy is divided into *natural philosophy* (or "physics"), *practical philosophy* (especially "ethics"), and *semantical philosophy* (the "doctrine of signs" and especially "logic").

An important transformation of this way of organizing the subject is reflected in the Stoic characterization of philosophy as depicted in Table II. The Stoics adopted and adapted the tripartite pattern of organization that underlay the Aristotelian scheme, taking philosophy to consist of *logic* (dealing with the rules for validating the truth of statements), *physics* (which depicts nature in the light of these rules), and *ethics* (which considers the harmonization of intelligent agents with nature).

The Stoics introduced some important departures from the "Aristotelian" picture, by:

(1) Simplifying logic in replacing the Aristotelian syllogistic by Stoic propositional logic,

(2) Dismissing the theory of *informal* reasoning, ejecting it altogether from the domain of logic (and philosophy).

(3) Abolishing psychology in consequence of a materialism that makes it plausible to subsume psychology (and epistemology) under physics, and to absorb the whole of metaphysics into physics.

(4) Abolishing social ethics (or politics) in consequence of a materialistic individualism or nominalism that saw no need to look beyond the level of individuals.

The contrast between the Stoic and the Aristotelian configuration of the subject is thus highly instructive. It illustrates the important fact that a philosopher's or a philosophical school's substantive doctrine crucially shapes and canalizes their view of the nature of the discipline. When a philosophical position does away with a certain category of objects, it automatically abolishes a certain (purported) sector of the subject as well. Thus, as the Stoic precedent illustrates, an individualistic nominalist, who denies to the "body politic" an independent existence of its own, has no significant place for the theory of social aggregates and political complexes represented by political philosophy along its traditional lines.

In *De Finibus*, Cicero offered a restated version of the Peripatetic position, a fourfold scheme that separates politics from ethics:

- Logic (*disserendi ratio*);
- Physics (*cognitio naturae*);
- Ethics (*de summo bono*);
- Politics (*civilis* = civics; *de re publica et de legibus*).

Cicero's four-part scheme brings politics into the forefront and reflects his sensible objection against the Stoics' neglect of this subject.[1]

Boethius bequeathed to the medievals the division of the philosophical sciences set out in Table III. Again a comparison with the Aristotelian scheme is instructive. Logic is now firmly categorized as an *instrument* of philosophy rather than a *part* of it, having no characteristic subject-matter. Physics swallows up psychology – as with the Stoics. Theology annexes the whole of the Aristotelian metaphysic of immaterial and changeless existence. The ethics of groups becomes divided. The most curious and characteristic aspect of this scheme is its Platonic elevation of mathematics into a place of separate and special prominence – the *mathematica* that constitute the medieval *quadrivium*. (The *logica* of the medieval *trivium* with its division of logic into the grammar, dialectics and rhetoric, goes back at least to Flavius Cassiodorus (ca. AD 550).)

TABLE III
The classification of philosophical disciplines according to Boethius (ca. AD 480–525)

(METHODOLOGICAL PROPADEUTIC: *Logic*)

SPECULATIVE PHILOSOPHY
- *Mathematics* (material bodies considered apart from matter and motion)
  - o geometry
  - o arithmetic
  - o astronomy
  - o music
- *Physics* (material bodies in motion; so that *Psychology* is included)
- *Theology* (changeless, immaterial things, i.e. *Metaphysics*)

PRACTICAL PHILOSOPHY
- *Ethics*
  - o moral philosophy (individual ethics, "monastics")
  - o "familial" ethics ("domestics")
  - o social ethics ("politics")

Source: Boethius, *De trinitate* in *The Theological Tractates*, tr. by H. F. Stewart and E. K. Rand (Cambridge, MA: Loeb Classical Library, 1973), pp. 8–10. Compare James A. Weisheipl, "The Nature, Scope, and Classification of the Sciences" in D. C. Lindberg (ed.), *Science in the Middle Ages* (Chicago, 1978), esp. p. 471.

2. THE MIDDLE AGES AND EARLY MODERN TIMES

Retaining the essentials of the Boethean picture, the medievals insisted on restoring logic to its old place of pride as a distinct branch of philosophy. Thus, in the *Eruditio didascalia* (or *Didascalicon*) of Hugh of St. Victor, we find the classification of philosophical sciences set out in Table IV.

In general, this scheme is a fusion of the Aristotelian and Boethian taxonomies of the philosophical sciences, supplementing the latter with the logical disciplines stressed by the former. (When asked the question "Is logic an *instrument* of philosophizing or a *part* of philosophy?" most schoolmen answered with the sensible reply that it is both – philosophy *embraces* the study of its own methods of thought.) Note that Hugh's classification accommodates the whole of the medieval arts curriculum – the trivium (grammar, logic, rhetoric) and the quadrivium (arithmetic, geometry, music, astronomy). Having evolved from the Aristotelian taxonomy, it is small wonder that such a scheme was able to acclimatize itself to the reintroduction of Aristotelian learning in the 12th century

TABLE IV
The classification of philosophical sciences according to Hugh of St. Victor (1096–1141)

LINGUISTIC SCIENCE (*scientia sermocinalis*: "Logic" broadly construed)
- *Grammar*
- *Dialectics* ("Logic" narrowly construed)
- *Rhetoric*

SPECULATIVE OR THEORETICAL SCIENCE (*scientia naturalis*)
- *Mathematics*
  - o geometry
  - o arithmetic
  - o astronomy
  - o music
- *Physics* (including *Psychology*)
- *Theology/Metaphysics*

PRACTICAL OR ACTIVE SCIENCE (*scientia moralis*)
- *Ethics*
  - o ethics of the individual (morals proper)
  - o ethics of the family (economics)
  - o ethics of the state (politics)

Source: James A. Weisheipl, 'The Nature, Scope, and Classification of the Sciences', in D. C. Lindberg (ed.), *Science in the Middle Ages* (Chicago, 1978), p. 474.

renaissance. The eventually standard scholastic classification of the sciences appeared as follows:[2]

TRIVIUM (Logic)	QUADRIVIUM (Mathematics)	PHILOSOPHY (proper)
Rhetoric	Music	Ethics
Dialectic	Astronomy	Metaphysics
Grammar	Arithmetic	Physics
	Geometry	

The result is a reshuffle of Hugh of St. Victor's theoretical classification designed to meet the curricular demands of the medieval academy.

In "Philosophy", says Bacon, "the contemplations of man do either penetrate unto God, or are circumferred to nature, or are reflected and reverted upon himself; out of which several inquiries there do arise three knowledges, divine philosophy, natural philosophy, and human philosophy or humanity."[3] The prime objects of philosophy are accordingly

three: God, nature, and man; and the resultant picture of philosophy consists of *doctrina de numine, doctrina de natura*, and *doctrina de homine*. An essentially tripartite scheme recurs once again. Apart from the neglect of logic natural to the author of the *new* Organon, we still retain the Aristotelian catalogue of philosophical themes, partitioning the subject according to the topic of concern:

(1) God: *theology* (natural and revealed).
(2) Nature: *physics*
(3) Man: *ethics* and *politics*

Christian Wolff's encyclopedic conception of philosophy is depicted in Table V. Projected in the late 1600's, it too is thoroughly conservative in its fundamentally Aristotelian view of the subject. Where the Stoics departed from Aristotle by absorbing metaphysics into physics, Wolff reversed the position and subsumed all of natural philosophy under metaphysics. Metaphysics is now taken (in the still standard way) to concern itself not only with immaterial existence, but with existence in general. The Wolffian picture prevailed for some hundred years in the German philosophical orbit, until its revision in the wake of Kant's influence. It too pays tribute to the far-reaching and perduring influence of scholasticism. To all intents and purposes, Wolff's scheme simply replicates that of Boethius except for expelling mathematics and physics into the realm of the special sciences, retaining only their specifically metaphysical involvements.

TABLE V
The taxonomy of philosophy in Christian Wolff (1679–1754)

METHODOLOGICAL PROPADEUTIC
– *Logic*
METAPHYSICS OR THEORETICAL PHILOSOPHY
– *Ontology* (or "First Philosophy")
– (rational) *Cosmology* – in contrast to physics
– (rational) *Psychology* – in contrast to empirical psychology
– (rational) *Theology* – natural in contrast to revealed theology
PRACTICAL PHILOSOPHY
– *Ethics*: Philosophy of individual agents
– *Economics*: directed at families and social groups
– *Politics* (and *Philosophy of Law*): directed at entire states and societies

Source: The organization of Wolff's writings themselves.

The view of philosophy of the *Encyclopedie*, given in Table VI, is reactionary in this regard. Here natural philosophy (i.e. natural *science*) is still entrenched as firmly as ever as a department of philosophy.

TABLE VI
The taxonomy of philosophy in the *Encyclopédie*

ONTOLOGY
- *General Metaphysics*: science of being in general

SCIENCE OF GOD
- *Theology* (in its various branches)

SCIENCE OF MAN
- *Pneumatology* (psychology)
  - rational
  - sensitive
- *Logic*
  - art of thinking
  - art of remembering
  - art of transmitting
- *Ethics*
  - general ethics (moral philosophy)
  - particular ethics (science of laws or jurisprudence)

SCIENCE OF NATURE
- *Corporeal Metaphysics* ("general physics")
- *Mathematics*
- *Particular Physics* (specialized branches of natural science)

Source: Jean le Rond d'Alembert, *Preliminary Discourse* (to the *Encyclopédie* of Diderot), tr. with intro. and notes by R. N. Schwab (Indianapolis and New York, 1963), pp. 144–145.

By the nineteenth century, philosophers had abandoned all claims to theology, and natural philosophy in general (and cosmology in particular) had emigrated to physics, now expelled into a separate "scientific" sphere. Moreover, the post-Kantian era had consolidated an interest in technical epistemology as a specialty in its own right. Accordingly, the picture of philosophy shown in Table VII emerged – in England at any rate.

On the Continent, the situation was far more complex. The impetus of Fichte, Schelling and Hegel created a great stirring in whose wake the

TABLE VII
The view of philosophy in late nineteenth century England

LOGIC

METAPHYSICS or FIRST PHILOSOPHY
- *Ontology* (preeminently)

MENTAL PHILOSOPHY
- *Psychology*
- *Epistemology*
- *Aesthetics*

MORAL PHILOSOPHY
- *Ethics* (personal morality)
- *Economic Philosophy* ("Political Economy")
- *Social Philosophy*
  - Political Philosophy
  - "Sociology" or Social Philosophy

Source: Various surveys.

philosophy of knowledge (in the broad sense of *Wissenschaft*), the philosophy of history, and the philosophy of religion came into prominence. With Dilthey, moreover, the philosophy of culture (including the philosophy of philosophy itself), came to the fore. Flourishing philosophical interest in man and his works characterized the development of Continental philosophy in the post-Kantian era.

3. A LATER PICTURE

A classificatory structuring of philosophy that was influential in the Anglo-American orbit in the first part of this century is that of the 11th (1910–1911) edition of the *Encyclopaedia Britannica* – the "six fields" scheme of Table VIII, which is a somewhat tidier reshuffle of the taxonomy of Table VII with the "Hegelian" additions of philosophy of religion and philosophy of history. (The sequence of written tests that constitutes the marathon, five-day, five-part "general examination" for doctoral candidates in philosophy at Princeton in my own student days (1949–1951) was still based on exactly this scheme, with aesthetics and psychology deleted, and "history of philosophy" introduced as an added item.) It should be noted that this "six-field" classification still carries

TABLE VIII
The "six fields" scheme of philosophy (ca. 1890–1920)

PHILOSOPHY OF KNOWLEDGE
- *Logic* (deductive and inductive)
- *Epistemology*

PHILOSOPHY OF EXISTENCE
- *Metaphysics* (including Philosophy of Nature and Philosophy of Religion)
- *Psychology*

PHILOSOPHY OF VALUE
- *Aesthetics*
- *Ethics*
  - Moral Philosophy
  - Social and Political Philosophy (including Philosophy of History)

Source: Based on the topical scheme of the 11th Edition (1910–1911) of the *Encyclopedia Britannica*, Vol. 29 (Index Volume).

forward into the twentieth century the ancient tripartite division of philosophy.

4. TAXONOMIC DYNAMICS

In general, viewed abstractly from the theoretical point of view, a classificatory scheme can be changed in the various sorts of ways canvassed in Table IX. All of these processes are at work in the development of philosophy, where each era, and to some extent even each philosopher who addresses these issues, takes a characteristic view of the constitution of the subject, perhaps deeming certain fields eliminable, perhaps dividing others in a novel and idiosyncratic way. As the history of the subject amply demonstrates, taxonomic change is a prominent feature of the subject's development. Quarrel about the subject's *shape* is every bit as common as quarrel about its *contentions* – indeed they are part and parcel of the same issue.

This substantive, doctrine-reflective aspect of philosophical taxonomy means that *this taxonomical enterprise is also itself a philosophical one*. The question of the *proper* shape of philosophy is itself bound to be a philosophical question. This is graphically illustrated in the recurrent phenomenon of agenda abridgement that is encountered throughout the history of philosophy. The Stoics' inclination towards materialism led

TABLE IX
Processes of classificatory change

I. ELIMINATIVE PROCESSES
(1) *Expulsion*. Eliminating a category by exporting it from the classification at hand into some other scheme.
(2) *Annihilation*. Eliminating a category by maintaining it to be empty (useless), thus doing away with it altogether.

II. ORIGINATIVE PROCESSES
(1) *Introduction*. Originating a wholly new category, be it by importation from without or by creation *de novo*.
(2) *Fission*. Originating a category by dividing a preexisting one into several.
(3) *Fusion*. Originating a category by uniting several pre-existing categories into one.

III. REDISTRIBUTIVE PROCESSES
Shifting existing categories to different positions in the taxonomic scheme. As apart from simple *relocating*, we also have, in particular, the prospect of
(1) *Upgrading*. Advancing a category from a subordinate position to a higher-order taxonomic status.
(2) *Downgrading*. Degrading a category from a higher-order position to one of a more subordinate taxonomic status.

Note: The *replacement* of one category by a totally new one can be seen as a combination of elimination and origination.

them to eliminate psychology as a branch of philosophy separate from physics at large. Spinoza held that issues of value have no place in philosophy. The ancient sceptics and their latter-day Humean and positivistic successors sought to invalidate the entire subject of philosophy – or at any rate those parts of it not concerned with clarifying the methods of human knowledge and establishing its limits. Time and again, philosophers maintain that only certain of the field's putative issues actually belong to it – that only certain particular, doctrinally restricted ranges of discussion can be considered a matter of "doing philosophy".

5. THE POST-KANTIAN TRANSFORMATION

In place of the substantive, object-directed orientation of the metaphysicians of the old school, Kant substituted an analysis of the range and credentials of our *concepts* of things. The philosophers who fol-

lowed him were quick to exploit this stress on the conceptual nature of philosophy's concerns. With Kant and Hegel, they adopted the view that philosophy's prime concern is not with *objects* as such – philosophy, strictly speaking, does *not* deal with such items as God, nature, people, actions, etc. Rather, the focus of its concern is *concepts* (ideas, conceptions). Its mission is to study, analyze and systematize people's *ideas* about God, nature, people, actions, etc. As they saw it, philosophy is a second-order enterprise; it does not deal with the world's furnishings, but with people's conceptions (ideas, beliefs) about them. Thus, philosophy is a matter of the analysis and synthesis of *concepts* rather than the examination of *things* of some sort. Carried to extremes, this tendency reduces philosophy to the theory of knowledge.[4]

However, this seemingly radical reorientation of philosophy is not as drastic as it seems. Certainly, it appears to reduce its objects of consideration to concepts alone. Philosophy is seemingly reduced to the theory of conceptionalizing thought. But when one looks at it more closely, this "conceptual revolution" is less radical than it at first seems to be. For we cannot successfully distance things from our conceptions of them. "Tell me about X's, but be sure to do so without imparting to me your conception of them" is nonsense – and so is its converse. The principle of truth as *adaequatio ad rem* means that our (purportedly accurate) concepts and (purportedly true) beliefs about things reflect our best efforts to say what they are actually like. We cannot drive a wedge between our views of things and our conceptions of them. These second-order concerns cannot ever be clearly and totally separated from the first-order substantive issues. One cannot cultivate the philosophy of X – the philosophy of science or law or art or whatever – without a substantive concern with X itself.

It deserves note that one's view of the relation of philosophy to other fields can also have major repercussions on the taxonomy of the discipline. As per Wolff's ejection of mathematics, it can lead to losses not through *annihilation*, but through *emigration*, through setting up various subdisciplines of philosophy (as formerly constituted) as enterprises belonging to a different domain. Theology and natural philosophy (i.e. physics) so emigrated in the 17th century; political economy in the 19th century; psychology only in the 20th.[5] Impressed by this phenomenon, Bertrand Russell wrote:

> (A)s soon as definite knowledge concerning any subject becomes possible, this subject ceases to be called philosophy, and becomes a separate science. The whole study of the

heavens, which now belongs to astronomy, was once included in philosophy. . . . Similarly, the study of the human mind, which was, until very lately, a part of philosophy has now been separated from philosophy and has become the science of psychology. . . . (T)hose questions which are already capable of definite answers are placed in the sciences, while those only to which, at present, no definite answer can be given, remain to form the residue which is called philosophy.[6]

We arrive at the engaging (but quite unrealistic) picture of the discipline gradually destroyed through progress of knowledge, being emptied through the emigration of all its issues into the special sciences.

However, the predominance of the post-Kantian transformation to a concept-oriented construction of philosophy has in recent days importantly countervailed against the ongoing emigration of disciplines from the realm of philosophy. We observed earlier that such fields as theology, "natural philosophy", political economy, and psychology have all emigrated from philosophy in the course of time. But the prospect of dealing with concepts and concept-manipulative processes (methods) means that philosophy can always retain a residue after such emigration. And so philosophical theology, philosophy of science, philosophy of economics, and philosophical psychology have all continued as flourishing enterprises, even after these subjects left philosophy's fold to set up shop on their own. In principle, the emigration or exportation of a philosophical subdiscipline is never a final loss because its concept-oriented cousin always remains behind to take its place. Owing to "the way of ideas", eliminations from philosophy are never taxonomically final. Even when the substantive issues of a field fall into other hands, its conceptual and methodological issues can remain objects of concern to the philosopher.

6. TAXONOMIC PROLIFERATION

It is clear from Table IX above that the nature of taxonomic change does not by itself constrain proliferation. There is no reason of abstract principle why fission should predominate over fusion in philosophical development. But fission and elimination always rest on a substantive thesis that reflects the theory of a particular thinker or school, leaving unaffected the broader question of what has been distinguished in the community at large. Thus from the angle of a description of the enterprise at large, proliferation is decisive in a way that reduction is not.

Philosophy, like other scientific and scholarly disciplines, is in fact involved in an ongoing proliferation of units and subunits. Specialization and division of labor confront us at every turn, driven by the dialectical nature of the discipline – the ongoing discussion proceeds through controversy, by way of objections and replies. There is a need for ever more fine-grained distinctions and details. The dialectical structure of thesis-objection-response that characterizes a scholastic treatise, and the exponential growth of controversial exchanges of the type at issue in the Leibniz-Clarke correspondence, afford examples. One must acknowledge the importance of the insight that led Melvil Dewey to devise the Dewey Decimal System of bibliographic classification: that an adequate taxonomic scheme for any area of inquiry – philosophy included – must provide for continuing ramification and sophistication, for ongoing exfoliation from within.

In consequence, the general picture of philosophy at the overall communal level is destined to grow more and more complex in the course of time. It rolls along like an enlarging snowball, gathering in ever more material. Once introduced, new issues remain part of the "permanent record" – demanding their place in libraries, textbooks, and educational curricula. A philosopher may have a simple picture of the subject – the discipline as he himself views its proper constitution may have a structure of the most austere economy. But the communal picture grows ever more luxuriant – ever more complex and ramified.

Herbert Spencer's picture of evolutionary development prevails. Evolution, he said, is a matter of passage "from a relatively indefinite, incoherent homogeneity to a relatively definite, coherent heterogeneity."[7] This may or may not hold for *biological* evolution, but it unquestionably does hold for *philosophical* evolution when it is the discipline at large that we keep in view.

7. THE CONTEMPORARY SITUATION

The current (1980s) picture of the taxonomic lay of the land in philosophy is thus vastly more complex and ramified than anything that has preceded it. Table X gives an overview of the situation, which reflects the burgeoning of philosophical study and writing after World War II. The complexification of the subject has burst the bounds of the ancient tripartite scheme for good. The situation has grown so complex and

diffuse that the most comprehensive recent English-language encyclopedia of philosophy[8] cautiously abstains from providing any taxonomy of philosophy whatsoever.

This survey of the current situation clearly exhibits the workings of a certain general process in the formation of philosophical subfields. For every mode of human activity (throughout the entire range from science, industry, business, medicine, and law, to art and even such recreations as sports or games of chance) we can, in principle, theorize philosophically regarding:

- the process of the activity (its methodology and praxis);
- the products of the activity and their place in the larger scheme of things;
- the ethics of the activity.

This circumstance has resulted in the recent explosion of philosophical subdivisions. And there is no reason why it cannot be extended further. (For example, I know of no philosophical treatments of the ethics of education, on analogy with the currently flourishing areas of medical ethics and business ethics. But, in principle, such an enterprise could certainly exist.) The resultant expansion of the discipline has produced a situation where no university has a Department of Philosophy large enough to have specialists in even half of the major subdivisions of the domain. Institutional philosophy has become unable to represent philosophy itself. This phenomenon also goes a long way towards explaining why no one has written a comprehensive history of philosophy that carries through to the contemporary scene and also why the traditional biographical approach to philosophical historiography is increasingly unsatisfactory.

The broadening of methodological scope from logic to inquiry in general, and the enhanced concern for the creative products of human activity, are, it would seem, the most far-reaching structural alterations that have come upon philosophy in modern times. This profound change of perspective is the fruit of the collective effort of the post-Leibnizian tradition, inspired by this master's view that cognitive systematization is a prime task of philosophy. The Leibniz-Wolff approach to philosophy manifests the encyclopedic conception of philosophy as "sciography" (to use Alexander Gottlieb Baumgarten's splendid term), the cognitive geography, as it were, of human knowledge in general. The projection of such a conception carries with it a reconceptualization

TABLE X
The subdivisions of philosophy (ca. 1980)

Object of Consideration	Branch of Philosophy
God	Philosophy of Religion/Philosophical Theology
Nature ("the physical world" and "the biological world")	Metaphysics/Philosophy of Nature
Mankind	
– "the human condition" in general	Philosophical Anthropology
– the human mind and its operations	Philosophy of Mind/Philosophical Psychology
Society (community)	Social Philosophy/Political Philosophy/Philosophy of Organizations
– social organization	
– social policy	Applied Philosophy
Individuals	
– re. action and interaction in their ethical dimension	
At large	Ethics (personal)/Moral Philosophy
In special contexts	Applied Ethics ○ Medical ethics ○ Business ethics ○ Bioethics ○ (others)
– re. thought	(see the rubric *Artifacts* below)
Artifacts: Processes (Mechanisms/Methods/Methodology)	
– Cognitive	Theory of Knowledge/Epistemology/ Methodology of Inquiry Theory of Everyday Knowledge/General Epistemology Theory of Experience (Phenomenology) Theory of Evaluation (Value Theory, Axiology) Theory of Demonstrative Inference (Deductive Logic) Theory of Inductive Inference (Inductive Logic) Theory of Scientific Method Theory of Rational Discourse (Dialectics) Theory of Probabilistic and Plausible Reasoning Theory of Interpretation (Hermeneutics) Theory of Learning (Philosophy of Education) (others)

(*contiued on p. 128*)

(TABLE X *continued*)

Object of Consideration	Branch of Philosophy
– Behavioral	
○ Linguistic	Philosophy of Language
	Philosophy of Communication Processes
○ Non-Linguistic	Theory of Action (Praxiology, Action Theory, Decision Theory, Theory of Rational Choice and Preference, etc.)
	Philosophy of Sport
Artifacts: Products	Philosophy of Natural Science (with subdivisions by special sciences)
	Philosophy of the Social Sciences
	○ Philosophy of Economics
	○ Philosophy of History/Historiography
	○ Philosophy of Law (Jurisprudence)
	Philosophy of the Formal Sciences
	○ Philosophy of Logic
	○ Philosophy of Mathematics
	Philosophy of Culture and Humanistic Learning (of the "Arts")
	○ Philosophy of Art (Aesthetics)
	○ Philosophy of Literature
	○ Philosophy of Philosophy (Metaphilosophy)
	Philosophy of Physical Production (of the "Crafts")
	○ Philosophy of Work
	○ Philosophy of Technology

Source: A survey of courses of instruction in universities and of the topical coverage of specialized journals in the field.

of philosophy. It is no longer thought of in *genetic* terms – as the collection of topics dealt with by the ancients under the rubric of "philosophy". Wolff defined philosophy in *functional* terms as "the science of all possible things insofar as they are able to come to existence" (*scientia possibilium, quatenus esse possunt*). This paved the way to broadening the range of philosophy – a prospect that was immediately capitalized upon by Baumgarten and Meier with the addition of aesthetics as a major branch of philosophy, but later expanded by leaps and bounds.

The rapid growth of "applied philosophy" – i.e. philosophical reflection about detailed issues in science, law, business, social affairs, etc. is another striking structural feature of contemporary philosophy. In particular, the past three decades have seen an amazing proliferation of narrowly focussed philosophical investigations of particular issues in areas such as economic justice, social welfare, ecology, abortion, population policy, military defense, and so on.

With regard to Table X, it should be noted that there has also been, in general, a substantial *internal* development within each of these various subdisciplines. Every category has seen the exfoliation of an internal structure of substantial complexity. The situation of logic, depicted in Table XI, affords a vivid example of this pervasive situation. This table illustrates the most characteristic feature of contemporary philosophy: the emphasis on detailed investigation of special issues and themes. For better or for worse, philosophers in recent years have tended to stay away from large-scale abstract matters of wide and comprehensive scope, to focus their investigations on issues of small-scale detail that relate to and grow out of those larger issues of traditional concern. The turning of philosophy from globally general, large-scale issues to narrowly focussed inquiries into highly specific matters of microscopically fine-grained detail is a characteristic feature of 20th century philosophy in contrast with its 19th century antecedents. This flourishing use of the case-study method in philosophy is a striking phenomenon for which no one philosopher can claim credit – to a contemporary observer it seems like the pervasively spontaneous expression of "the spirit of the times".

8. THE PROBLEM OF PROGRESS

Specialization goes hand in hand with a division of labor. An impressive feature of modern philosophy that matches its passion for detail is the ongoing expansion of the horizons of philosophical concern. Clearly, it is a mistake to think of philosophy as something fixed and given – formed and frozen for the ages. Not only do new issues, questions, distinctions, etc. spring up in philosophy, but entire new branches emerge.[9] The history of the discipline, seen as a whole, manifests an ongoing development in the range and scope of its concerns, and in particular, an increasing humanization – an ongoing preoccupation with the activities and works of man.

TABLE XI
The taxonomy of contemporary logic

I. *Protologic*: logical principles of linguistic resources
- logical syntax
- logical semantics
- logical pragmatics

II. *Inferential (Deductive) Logic*

(1) STANDARD VERSIONS
- propositional logic
- quantificational logic
- modal logic
- many-valued logic

(2) NONSTANDARD VERSIONS
(replication of (1) through such variants as, e.g. intuitionistic logic)

III. *Metalogic*
- theory of definability
- theory of assertability
- theory of provability and decidability
- logical paradoxes and their resolution

IV. *Non-Assertoric Logic*
- logic of questions
- logic of commands
- logic of obligation-statements (deontic logic)
- others

V. *Inductive and Probabilistic Logic*
- Keynes-style probability logic
- Carnap-style inductive logic
- others

VI. *Applied Logic*
- mathematical applications (e.g. combinatory logic)
- physical applications (e.g. quantum logic)
- social scientific applications (e.g. logic of preference)
- many others

Certainly, there is no emerging agreement on the substantive issues. Philosophy progresses not by way of developing doctrinal consensus but by way of greater methodological sophistication, differentiation, and elaboration. In philosophy, we do not arrive at communally acceptable

solutions to our problems, but we treat them in a way that takes an ever more complex account of rival positions. What comes to view with the passage of time is not an emerging agreement among philosophers on what the answers are, but an increased sophistication in the concern for ever-ramifying detail in treating the issues. Taxonomic proliferation is thus an index of the characteristic sort of progress we can and do attain in philosophy, taken in its disciplinary totality.

9. THE DIALECTIC OF THE INDIVIDUAL AND THE COMMUNITY

To sustain this picture of progress geared to ongoing taxonomic complexification, it is necessary, to distinguish two very different levels of consideration: first that of the *individual* philosopher, and second that of the philosophical *community* as a whole, as reflected in the doctrine-detached, substantively uncommitted standpoint of descriptive historians, bibliographers, survey-writers, and curriculum planners. This distinction between the communally aggregate (descriptive) position of the discipline at large and the doctrinally substantive (normative) position of particular philosophers is crucial for our present concerns.

Any one *particular* philosopher's view of the subject is bound to reflect his own substantive allegiances. (Atheists do not want philosophical theology, positivists see no place for metaphysics, Spinozists leave no room for a theory of value – perhaps with the exception, in each case, of just enough scope to state and defend the doctrine in question.) This sort of viewpoint is fair game for a philosopher. But a *student* of philosophy is not free to pick and choose. He must include the whole community in his taxonomic purview.

Without doubt, the question of the *proper* taxonomy of philosophy is itself a philosophical issue that can only be resolved from the vantage point of a particular substantive doctrine. It rests on *value* judgments, revolving around questions about what is meaningful, worthwhile and important. And so, it is an inherently controversial part of philosophizing itself. One cannot address this issue of the *proper* structure of philosophy save from the vantage point of a substantive philosophical position, which may well proceed to dismiss entire branches of the subject as inappropriate – exactly as per logical positivism's dismissal of metaphysics and of ethics. No doubt, it is only from the standpoint of the *student* of philosophy – who has to provide for the productions of the community at large – that the discipline "progresses" by way of taxonomic complexification. The individual philosopher, proceeding on the

basis of his own doctrinal position, can adopt a view of the subject that exhibits great paucity and simplicity. (Every philosopher is potentially his own taxonomist!)

But, of course, a factual and descriptive preoccupation with the dealings of the philosophical community at large is something very different from substantive philosophizing. It is an essentially bibliographic matter of descriptive content-analysis that seeks to detect the ideational configuration of philosophical discussion. All this is a matter of providing a description of philosophizing rather than engaging in it. It is necessary to distinguish clearly between two very different things:

(1) A given philosopher's own view of the proper nature of the subject, which is bound to reflect *his own substantive position* on philosophical issues;

(2) the situation of the philosophical community at large as reflected in the "merely descriptive" bibliographical classification of books, the range of specialized journals, the topics of conferences, the subjects of instructional course offerings, etc.

In this second case, what is at issue is an overview of the entire enterprise – a picture of the whole spectrum of competing positions. Of course, such a *survey* of philosophical views about the progress, nature and structure of philosophy does not itself *constitute* such a view. The position of the community is not available to the individual because of its internal conflicts and contradictions. We cannot extract a viable doctrine from the position of the community at large because such a doctrine must be coherent, whereas the community, unable to achieve consensus, invariably rides off in very different directions in a fission that awaits and invites the labors of descriptive systematization. In philosophy as elsewhere, a catalogue of proposed answers to questions does not furnish an answer. And so a descriptively synoptic account of philosophizing cannot provide a *substantive* taxonomy of philosophy that gives an account of its *proper* nature.

The converse is true as well. Any one philosopher's own substantive position will leave the communal situation substantially unaffected. He may say that metaphysics is nonsense – that nobody *should* bother about those issues. But, of course, that fails to ensure that no one *does* bother

about them. No philosopher can legislate what the overall position of philosophy *de facto* is – this is something with which the historical course of events simply presents him, like it or not.

The irony is that even those philosophers who abhor the very idea of theses and systems – the ancient sceptics, the later Wittgenstein, the partisans of hermeneutics and deconstruction – are destined to carry grist to the mills of the systematizers and to take a place in the serried ranks of their constructions. Their books too must find a place in the catalogue, their views in the historical accounts, their beliefs in the surveys of doxographers. One no more escapes the reach of systematization by disapproving of it than one eludes being a mortal by disliking mortality.

10. CONCLUSION

Throughout the history of Western philosophy, since the days of the Presocratics, the condition of the subject has been a Hobbesian state of nature – a *bellum omnium contra omnes* pitting rival against rival, master against student, friend against friend. Any philosopher must soon come to terms with the fact that other philosophers will not agree with his views on the substantive issues of the discipline. Similarly, he must also come to terms with the circumstance that his colleagues will also not agree with his views regarding the nature, and even the very structure of the field. This is so striking a phenomenon that one writer has proposed, no doubt tongue-in-cheek, to *define* philosophy as "the discipline whose prime task is the determination of its own boundaries"[10] – a thesis that holds just as much for internal as for external boundaries.

Confronted with the question "What is the structure of philosophy?", the conscientious philosopher is bound always to give *two* answers: namely how the matter looks from the normative angle of *his own philosophy*, and how it looks from the descriptive angle of the labors of *the community at large*. These answers correspond roughly to the questions: How should philosophy properly be done? How is philosophy actually being done? Recognition of this divergence between what is, and what (in his view) ought to be will inevitably confront a philosopher with the task of giving an account of the relation between the two. He faces the problem of supporting *his own* conception of

philosophy in the face of other views regarding not just the *solution* of problems, but of what these problems actually are in the first place – what questions properly belong to the discipline at all. This fundamental issue of the nature and structure of his subject is one the philosopher can avoid only at the cost of neglecting an important part of his overall job.

CHAPTER ELEVEN

IS PHILOSOPHY A GUIDE TO LIFE?

1. PHILOSOPHY: THE PROBLEMATIC GUIDE

Philosophers supposedly see the task of their subject as providing rational guidance to thought and action – answering "the big questions" about the world, ourselves, and our place in its scheme of things. But does philosophy provide such answers? The motto of Phi Beta Kappa, America's oldest academic confraternity, is the proud dictum "Philosophy is the guide of life" (*philosophia biou kybernétés*). But is this claim defensible? Does philosophy indeed provide a satisfactory guide to decision and to action in the practical affairs of life?

It is all too clear that capital-P Philosophy affords no useful guidance for the governance of our affairs. Philosophy at large has no theses, lessons, teachings – only possible problems and conflicting solutions. It is a domain of clashing contentions without consolidated results. And no one bears more eloquent testimony to this than the philosophers themselves, who have seldom, if ever, reached consensus on substantial issues.

Descartes, the founding father of modern philosophy, complained as follows:

> I shall not say anything about philosophy, but that, seeing that it has been cultivated for many centuries by the best minds that have ever lived, and that nevertheless no single thing is to be found in it which is not subject of dispute, and in consequence which is not dubious, I had not enough presumption to hope to fare better there than other men had done. And also, considering how many conflicting opinions there may be regarding the self-same matter, all supported by learned people, while there can never be more than one which is true, I esteemed as well-nigh false all that only went so far as being probable.[1]

In the 18th century, David Hume deplored philosophy's chaotic lack of consensus in these terms:

> (W)ant of coherence in the parts, and of evidence in the whole, these are everywhere to be met with in the systems of the most eminent philosophers, and seem to have drawn disgrace upon philosophy itself . . . (E)ven the rabble without doors may judge from the noise . . . within. There is nothing which is not the subject of debate, and in which men of learning are not of contrary opinions. The most trivial question escapes not our

controversy, and in the most momentous we are not able to give any certain decision. Disputes are multiplied, as if every thing was uncertain; and these disputes are managed with the greatest warmth, as if every thing was certain. Amidst all this bustle 'tis not reason, which carries the prize, but eloquence; and no man needs ever despair of gaining proselytes to the most extravagant hypothesis, who has art enough to represent it in any favourable colours. . . . From hence in my opinion arises that common prejudice against metaphysical reasonings of all kinds, even amongst those, who profess themselves scholars. . . . [2]

A century later (in 1867), Wilhelm Dilthey wrote that:

(Many think that) the development of philosophy encompasses through all those various systems a succession of systems which approaches a single perfected system in unending approximation. However in reality every age manifests the strife of all these systems among one another. This includes the present age, which shows no sign that this strife of systems is diminishing.[3]

And Dilthey went on to note that, in consequence of this, the tendency of the time was:

to treat the systems of these philosophers as a series of delusions, akin to a bad dream which, on awaking, one had best forget altogether.[4]

In the late 1920's, Moritz Schlick gave expression to a similarly discouraging view:

But it is just the ablest thinkers who most rarely have believed that the results of earlier philosophizing, including that of the classical models, remain unshakable. This is shown by the fact that basically every new system starts again from the beginning, and that every thinker seeks his own foundation and does not wish to stand on the shoulders of his predecessors. . . . This peculiar fate of philosophy has been so often described and bemoaned that it is indeed pointless to discuss it at all. Silent scepticism and resignation seem to be the only appropriate attitudes. Two thousand years of experience seem to teach that efforts to put an end to the chaos of systems and to change the fate of philosophy can no longer be taken seriously.[5]

Philosophy, Croce maintained:

gives rise to those inconclusive and interminable arguments which are so frequent with professional philosophers that they seem to have become a natural element in their lives, where they come and go . . . in vain, always agitated here and there and everywhere, but always at the same stage of development.[6]

The litany of dismay echoes down the ages, complaints regarding unsettled issues, undecisive controversy, unending disputes and unachieved consensus. For two and a half millennia, philosophers have grappled with those "big questions" without resolving anything. We

look in vain for one consolidated and generally conceded item of "philosophical knowledge," one "philosophical fact" on which the community has reached a settled consensus.

Down the centuries, philosophers have recognized and lamented the inability of their discipline to lay to rest the disagreement of the past and to reach fixed and settled conclusions. They have often cast envious sidelong glances at the sciences, with their demonstrated capacity to solve the problems and settle the controversies of the field and yield a continually increasing number of established findings that reflect a general consensus.

Philosophy – the enterprise as a whole, in the richly discordant diversity of its intramural conflicts and disagreements – obviously does not provide a guide to life. At this level of comprehensive generality, our questions get not one answer, but a babble of conflicting answers from which no useful guidance can be extracted. If we are to *apply* philosophy we must have a particular philosophy to apply. But there is no body of established and agreed theory in philosophy that one can "apply" in the way in which we can apply (say) physics or biochemistry. Just what are the implications of this circumstance?

2. THE PROBLEM OF "APPLIED PHILOSOPHY": ONLY ONE'S OWN PHILOSOPHY CAN PROVIDE GUIDANCE

Applied Philosophy has to do with the implementation of philosophical ideas, methods, and beliefs in resolving the cognitive, normative, and practical issues we face in everyday situations in the "real world". Now the key point that has to be borne in mind here when one speaks of "applying" philosophy is that there are different sorts of applications, ranging from *personal* applications to the governance of society's affairs. The former is relatively straight-forward. Once one *has* a philosophy, then this can usefully be put to work in making one's decisions and conducting one's affairs. But the issue of applying philosophy in the public domain raises more substantial difficulties.

For only insofar as there is an agreed-upon and shared "public philosophy" can one make use of philosophy as a basis for problem solving in the public forum. And at just this point one encounters a decisive roadblock. Living in a pluralistic, diversified, and ideologically balkanized society, we lack that agreed unity of doctrinal consensus which alone could furnish a philosophy that one could apply

unproblematically in the arena of public policy. At the level of social concerns, the very idea of "applied philosophy" is in difficulty because there is no communally available philosophy to apply.

At the outset of his *Meditations*, Descartes expressed the intention that, until his own philosophy was full-formed, he would continue to guide his conduct of life's affairs by the "extraphilosophical" resources of common sense and established custom. And this is surely a sensible course. For as Descartes clearly saw, philosophy-at-large can provide no guidance – for this one must await the development of *one's own* philosophy. Until we have formed our own framework of values and have thought through its implications, we had best cling to the security of the tried and tested course, and be guided by familiar customs and established ways. Until one's own philosophical position is ready, one can expect no useful guidance from philosophy.

Not the discipline as a whole but only the products of one's own particular mode of practicing it can possibly afford us helpful direction and informative answers. Neither in matters of thought nor in matters of action can philosophy-at-large tell us what is to be done – only the particular substantive positions which we accept can possibly do so. Only at this particularized level can we achieve a definite position regarding the right and the good, the beautiful and the sublime, the significant and the important. Such lessons are clearly bound up with the specific teachings of the particular philosophy one happens to espouse. It is from one's own philosophy, and not from philosophy *per se*, that guidance for our thought and action is to be extracted.

Philosophy only provides an exhibit stocked with diverse possibilities, a collection of blueprints. But a blueprint does not afford us a habitation: to have a dwelling place we must have some particular structure. Philosophy-in-general cannot answer our questions, this can only happen when we accept a particular philosophy.

We can get questions from capital-P Philosophy – i.e., from the enterprise at large. But if it is *answers* that we want (and it surely ought to be!) then we can only obtain them from *our own* philosophy. To obtain answers to our questions we must work them out on a basis which we can endorse. If we want to put philosophy to work we must first develop a philosophy to apply. Thereafter, there is no problem. Once we have a philosophy in place, we can draw upon it for counsel.

3. WHAT PHILOSOPHY PER SE CAN CONTRIBUTE

So much for the contribution of *our own* philosophy. But what of philosophy *per se*? Given that the enterprise as a whole does not and cannot achieve any stable resolution of the substantial issues, can we obtain any useful lessons from it?

We can indeed. Even the position-detached study of philosophy as a whole can provide a powerful stimulus to thoughtful reflection and a great aid to us in working out our own positions. The study of philosophy is "consciousness raising" – it makes us aware of problems and issues and sensitizes us to the bearing of various sorts of considerations. Its utility, however, is not that of a map which tells us what turns to make along life's journey, but of an intellectual stimulus towards cultivating those resources of reason and thoughtful reflection by which an intelligent person can tackle the problems he or she faces. The lessons of philosophy-at-large are not substantive but only methodological. And this of course stops well short of yielding concrete answers to philosophical questions. *Answers* are something we cannot obtain from philosophy-at-large – they come only from *our* philosophy.

Strictly speaking, there is but one way in which actually to "apply" philosophy – namely by first developing a philosophical position of one's own, and then proceeding to put it to work in resolving issues. It is obvious enough that to apply a philosophy one must first have a philosophy to apply. And this leads to difficulties in the public domain because we lack a public philosophy. We lack a consensus position accepted by "the public at large" as a basis for its deliberations.

4. SOME EXAMPLES OF "APPLIED PHILOSOPHY" IN THE PUBLIC DOMAIN

Yet things are not quite as bad as they seem. Those theoretical subtleties and carefully crafted distinctions which preoccupy the philosopher may not make much difference in real life. In many cases, the result of applying one particular parochial philosophy to the exclusion of others will not matter unduly because the issue are not sensitive to detail. Analytical care and common sense may alone suffice to enable us to arrive at a definite resolution – subtle doctrinal differentiations

become immaterial. The details of our substantive position just do not enter into it, so that it makes no difference that others may not agree with our position. Unhappily, such cases are rare.

Fortunately, however there remains that other, less committed way of "applying" philosophy where what is at issue is not the *substance* (results, findings) of philosophical inquiry, but its *methods*. In this methodological setting, we treat problems at arm's length rather than taking a committed position regarding their resolution. We delineate the issues, clarify the problems, pinpoint what questions must be decided, and examine what sorts of considerations must be taken into account. What is at issue is a matter of problem-clarification, something which, useful though it is, stops well short of problem-resolution.

There can be little question that *this* sort of "applied philosophy" can be practiced effectively in the domain of public policy. Nowadays we are surrounded by instances of this sort of "application" of philosophy to public policy issues by way of elucidation and issue-clarification. Let us take brief note of a few examples.

Environmental ethics affords a wide spectrum of illustrations. One of them relates to the issue of safeguarding and preserving our natural environment. In this connection, philosophers have stressed the different interests that various constituencies are bound to have, including constituencies that cannot participate in current deliberations regarding these matters because they do not yet exist – to wit, future generations. The allocation of obligation and responsibility becomes a problematic issue here. Environmental protection may impose economic and social burdens on the present generation – ones that significantly lessen its own level of well-being in order to safeguard assets and resources for future generations. How are such costs and benefits to be reckoned? And how are the burdens to be allocated? The informed philosopher's scrutiny of these matters can clarify the issues involved and pinpoint the factors that must be taken into account.

In legal philosophy, the question of confidentiality affords an example. To what extent should the client-attorney relation be one of sacred confidentiality? To what extent should the interests of third parties be protected by attorneys against potentially criminal wrongdoing by their clients? This becomes a matter of pitting the claims of some against the rights of others to reasonable security in life, limb, and property. Here again, philosophical scrutiny can greatly illuminate the problem and identify factors which an adequate handling of such issues must take into account.

Medical ethics is yet another major area of application where philosophical deliberation can help to facilitate the rational resolutions of conflicts. The ethical ramifications of the use of placebos is just one example. They pose a policy issue of weighing an individual's right to be adequately informed (to give "*informed consent*" to treatment) against the loss of the potential benefit of the use of a placebo and the compromising of the doctor's obligation to provide therapeutically appropriate care. Here too we have a policy issue that poses a conflict of considerations which philosophically informed scrutiny can do much to clarify.

Again, the domain of "critical thinking" which has leapt into prominence in philosophy over the past decade affords yet another rich field of examples. This venture dedicates itself to the critical analysis of reasoning in support of decisions regarding personal and social actions, with a view to unmasking invalid appeals in the rhetoric of persuasion and propaganda. The philosophically informed logician and epistemologist can do much to illuminate the issues here. Consider only one somewhat amusing instance. An editor of the Soviet journal *Science and Life* informed his audience (in the early days of space rocketry) that "the fact that satellites and space rockets have not detected the All-Highest, angels and so on, bears testimony against religious convictions and strengthens disbelief in God".[7] It is clear that a bit of philosophical analysis would shake the appeal of such an argument.

But enough of examples. The cases we have adduced are more than enough for our present aim – which is to draw attention to the essentially *methodological* nature of these "applications" of philosophy. They are all concerned with matters of *method* rather than *substance*. They serve to assure that the deliberations at issue are sensibly managed – that they are adequately developed and achieve *technical* merit. And this helps – though unfortunately, in the unavoidable absence of consensus on substantive issues, these methodological, commitment-free applications are seldom sufficient to provide an actual *solution* to the problems at hand. This is something that generally requires substantive commitments rather than merely technical mechanisms.

5. THE LIMITED UTILITY OF METHODOLOGICAL APPLICATIONS

What is at issue with this methodological mode of applied philosophy is not *problem-resolution*, then, but rather that crucial preliminary of *problem-clarification*. Such a procedure can enable us to

achieve technical adequacy in our deliberations. It can ensure that we pay attention to such matters as defining the issues, bringing to explicit recognition things that must be taken into account, pinpointing relevant considerations, avoiding confusions, identifying factors that must be distinguished, clarifying connections between seemingly disjointed considerations, drawing attention to ramifications and complexities that must not be lost sight of, etc. All the analytical and synthetic tools of philosophizing can be brought to bear, leading us to pay heed to the various pieces of the puzzle and coordinate them in their holistic unity. But all this methodological care only means that we have followed our route carefully; it does *not* mean that we will arrive at the proper destination.

To be sure, these methodological resources only assure that whatever solution we can secure though use of other (substantive) resources is well worked out and cogently presented. They cannot determine the *nature* of our problem-resolutions, but only that they are competently substantiated. Accordingly, their utility, though real, is limited. Precisely because they are not substantive they do not enable us to resolve the real issues themselves, which are almost always of substantive bearing. (Care of process and procedure does not guarantee adequacy of result. Great care and effort can be used to build up a house of cards.)

This methodologically oriented "applied philosophy" is a mode of cognitive accounting, as it were. It insists on methodological rigor in keeping the books – on clarity, consistency, and coherent integration. But when all is said and done this does not take us very far. For accountants as such do not get involved in matters of substance – the figures they juggle enter into executive decisions and assure that those who do make the decisions are able to see exactly what the upshot is in terms of the assets and liabilities they engender. Substance must come *ab extra* – not from methodology but from commitment.

This commitment should be provided by the client and not the applied philosopher himself. For when the applied philosopher projects his own views into the problem-solving process he does not simplify matters for anybody. Instead, he increases by one the number of agents who have to be accommodated, so that his presence impedes rather than facilitates problem-solving.

And there is further cause for concern here. Precious little in his strictly *philosophical* training equips the "applied philosopher" seeking to assist practical people in dealing with practical issues. Doctrines,

claims, theses, and theories are either acceptable or not acceptable to a person, – there is little one can do to blend them together or average them out or take half-measures with them. But this is *not* so where actions rather than beliefs are concerned, and where we have to deal not with doctrines or theories but with programs or policies for doing things. Here negotiation and bargaining, mixed strategies and halfway-house compromises are called for. In the real world, the best realizable resolution of issues is often a village of halfway houses. The matter is one of practical politics rather than ideology; of splitting differences rather than unifying finely wrought and coherent doctrines. And this theoretical untidyness of real-world arrangements is something for which the philosopher's theoretical training often leaves him ill equipped. It is something that renders the Platonic ideal of a politician-philosopher particularly difficult to achieve.

In providing technical expertise to help others in clarifying their reflections the philosopher must never push technical adequacy beyond the needs of the moment.

6. A DANGER OF "APPLIED PHILOSOPHY"

Such stress on the limits of applied philosophy reflects a danger that is never far removed from its operations. The unproblematic applications of philosophy in the public domain are, as we have seen, confined to the range of methodological issues. They are matters of *problem-clarification*, which is very different from (though obviously not irrelevant to) *problem-resolution*. But those who have these problems, the *clients* of applied philosophy, as it were, do not just want sharpened problems, they want *answers*. And the danger is that they will operate under the profoundly mistaken impression that those clever philosophers, so ingenious about analyzing and clarifying the issues, can also provide unproblematically acceptable solutions for them.

And of course, this is not the case. What applied philosophy *can* contribute at the level of public policy deliberations is clarification and definition of the issues. But it *cannot* solve them. Applied philosophers can provide a whole series of useful reminders about points to be distinguished and matters to be borne in mind. What they cannot do (short of a gratuitous injection of their own substantive views on the substantive issues) is to determine how claims should be resolved in the light of such considerations. For what is needed to resolve the really

knotty issues is not just methodology but substance, not philosophical acuity but a philosophical position. And this is exactly what the applied philosopher is not in a position to supply from his kit of value-neutral expertise. It takes a substantive commitment which he cannot – or *should* not – provide on his client's behalf.

The danger here is obvious. In turning to the applied philosopher as an "expert" in issue-clarification, the client may expect more than he can get and ask for more than the philosopher (*qua* conscientious methodologist) can possibly deliver. And at this point there is the unhappy temptation for the philosopher – who is, after all, only human and equipped with the natural human aversion to disappointing expectations – to pass off a personal position as unprejudicedly objective expertise.

Yet another danger arises. The applied philosopher is all too frequently torn between the theoretical proprieties of his professional discipline and the demands of his client for rough and ready resolutions. He is always being tempted to let the claimed result of his deliberations rest on a footing which he knows to be inadequate.

The philosopher is always concerned with exceptions, with the limits of generality, with what *might* go wrong even if it rarely does. He has to care for careful distinctions and saving qualifications. And this can cause problems for the practical man. A legislator at one point expressed a yearning for "one-armed experts", who would not constantly say "but on the other hand". In this regard the philosopher is a virtual octopus.

The course of the relationship between the applied philosopher and his clients is thus strewn with thorns. The applied philosopher's professional hazard is getting caught up in a frustrating tug of war between the demands of his professional conscience and the requirements of his client. The first thing he must do, *qua* analyst of complex issues, is to come to terms with the limited extent and imperfect nature of the service he can render within the proper limits of his particular enterprise. He would do well to subject his own proceedings to the critical scrutiny of his methods, taking to heart that splendid old precept: "Physician, heal thyself".[8]

NOTES

NOTES TO ESSAY ONE

[1] Quoted on p. 201 of Wolfgang van den Daele, 'Legitimationsprobleme der Naturekenntnis', in F. Rapp (ed.), *Naturverständnis und Naturbeherrschung*, Munich, 1981, pp. 186–213. This paper offers a thoughtful treatment of issues relevant to the present deliberations. Readers interested in pursuing these issues may also want to consult the Spring 1978 issue of *Daedalus: Journal of the American Academy of Arts and Sciences*, Vol. 107, which is devoted to the theme of 'Limits of Scientific Inquiry'.

[2] Quoted in *Daedalus*, 1978, Vol. 107, p. 24.

[3] This essay originated as a Philosophy Forum lecture delivered at Russell Sage College in November, 1985. In writing the paper I have profited from exchanges with Gerald Massey and Douglas Butler.

NOTES TO ESSAY TWO

[1] Arthur Pap, *Elements of Analytic Philosophy*, MacMillan, New York, 1949, p. 356.

[2] The definition vs. criterion dichotomy was the starting point of the author's *The Coherence Theory of Truth*, Oxford University Press, Oxford, 1973. It also provided the pivot for the critique of the coherentism of Blanshard's *The Nature of Thought* that I presented in R. A. Schilpp (ed.), *The Philosophy of Brand Blanshard*, Open Court, La Salle, 1980. Several subsequent publications have kept the pot boiling, in particular Scott D. Palmer, 'Blanshard, Rescher, and the Coherence Theory of Truth', *Idealistic Studies*, Vol. 12, 1982, pp. 211–230, and Robert Tad Lehe, 'Coherence – Criterion and Nature of Truth', *ibid.*, Vol. 13, 1983, pp. 177–189.

[3] This is an issue on which I have come to change my mind, largely owing to stimulating discussions held during the 1983–1984 academic year with Professor Lorenz Bruno Puntel of the University of Munich.

[4] Brand Blanshard, 'Reply to Nicholas Rescher' in *op. cit.*, pp. 589–600 (see p. 596).

[5] For a further development of these ideas, see the author's *The Coherence Theory of Truth*, Oxford University Press, Oxford, 1973; and *Cognitive Systematization*, Blackwells, Oxford, 1979.

[6] Brand Blanshard, *The Nature of Thought*, 2 volumes, Allen & Unwin, London, 1939, Vol. 2, pp. 267–68.

[7] This essay is a revised version of a paper of the same title published in the *Review of Metaphysics*, Vol. 38 (1985), pp. 795–806. In writing the paper I have profited by discussion with Dr. Geo Siegwart.

NOTES TO ESSAY THREE

[1] For further information on this subject see the author's *Plausible Reasoning*, Van Gorcum, Assen, 1976.

[2] The well-known "preface paradox" should be considered on this basis. The author is not really contradicting himself in telling us in the preface that some of the statements of the text are false. He is just putting us on notice that the text is printed in black ink (so to speak). The author believes those statements of the text all right and invites us to believe them as well. But only in the qualified way that characterizes the rational man's approach to the great bulk of factual issues.

[3] This presupposes that we have in hand a body of logical machinery that does not allow us to deduce anything and everything from an inconsistency, so that even a single inconsistency renders a body of assertions cognitively incoherent. But such inconsistency-tolerant (or "paraconsistent") logics – are nowadays abundant.

[4] Regarding the implementation of this line of thought see Nicholas Rescher and Robert Brandom, *The Logic of Inconsistency*, Oxford, 1979.

NOTES TO ESSAY FOUR

[1] Bentley Glass, 'Science: Endless Horizons or Golden Age?', *Science*, Vol. 171, 1971, pp. 23–29.

[2] *Ibid.*, p. 24.

[3] The geographic exploration analogy is an old standby: "Science cannot keep on going so that we are always going to discover more and more new laws. . . . It is like the discovery of America – you only discover it once. The age in which we live is the age in which we are discovering the fundamental laws of nature, and that day will never come again." (Richard Feynman, *The Character of Physical Law*, Cambridge, MA, 1965, p. 172. See also Gunther Stent, *The Coming of the Golden Age*, Garden City, NY, 1969, and S. W. Hawking, 'Is the End in Sight for Theoretical Physics?', *Physics Bulletin*, Vol. 32, 1981, pp. 15–17.)

[4] Marxist theoreticians take this view very literally – in the manner of Lenin's idea of the 'inexhaustibility' of matter in *Materialism and Empirico-Criticism*. Purporting to inherit from Spinoza a thesis of the infinity of nature, they construe this to mean that any cosmology that denies the infinite spatial extension of the universe must be wrong.

[5] 'Remarks by David Bohm', in *Observation and Interpretation*, ed. by Stephan Koerner (New York and London, 1957), p. 56. For a fuller development of Bohm's views on the "qualitative infinity of nature," see his *Causality and Chance in Modern Physics*, London and New York, 1957.

[6] A later writer put it this way: "Go on as far as we will, in the subdivision of continuous quantity, yet we never get down to the absolute point. Thus scientific method leads us to the inevitable conception of an infinite series of successive orders of infinitely small quantities. If so, there is nothing impossible in the existence of a myriad universes within the compass of a needle's point, each with its stellar systems, and its suns and planets, in number and variety unlimited." (W. S. Jevons, *The Principles of Science*, 2nd ed., London, 1877, p. 767.)

[7] The idea of a succession of "layers of depth" in the analysis of nature, each giving rise to its own characteristic body of laws in such a way that each of these law-manifolds is more encompassing than its predecessors and that their successive discovery represents a sequentially deeper penetration of the structure of nature was, so far as I know, first mooted in contemporary physics by E. P. Wigner, 'The Limits of Science', *Proceedings of*

the American Philosophical Society, Vol. 94, 1950, pp. 422–427. But it had already been contemplated by Charles Sanders Peirce, half a century earlier.

[8] Sir Denys Wilkinson, *The Quarks and Captain Ahab or: The Universe as Artifact*, Stanford, 1977; Schiff Memorial Lecture, pp. 4–5.

[9] 'The Concept of Probability in the Frame of the Probabilistic and the Causal Interpretation of Quantum Mechanics', in Stephan Koerner (ed.), *op. cit.*, p. 77. Cf. also E. P. Wigner in, 'The Limits of Science', *op. cit.*

[10] For an interesting and suggestive analysis of "the architecture of complexity," see Herbert A. Simon, *The Sciences of the Artificial*, Cambridge, MA, 1969.

[11] John Herschel, *Familiar Lectures on Scientific Subjects*, London, 1867, p. 458.

[12] This idea that our knowledge about the world reflects a *interactive* process, to which both the object of knowledge (the world) and the knowing *subject* (the inquiring mind) make essential and ultimately inseparable contributions, is elaborated in the author's books *Conceptual Idealism*, Oxford, 1973, and *Methodological Pragmatism*, Oxford, 1977.

[13] Compare D. A. Bromley's observation: "Even if physicists could be sure that they had identified all the particles that can exist, some obviously fundamental questions would remain. Why, for instance, does a certain universal ratio in atomic physics have the particular value 137.036 and not some other value? This is an experimental result: the precision of the experiments extends today to these six figures. Among other things, this number relates the extent or size of the electron to the size of the atom, and that in turn to the wavelength of light emitted. From astronomical observation it is known that this fundamental ratio has the same numerical value for atoms a billion years away in space and time. As yet there is no reason to doubt that other fundamental ratios, such as the ratio of the mass of the proton to that of the electron, are as uniform throughout the universe as is the geometrical ratio pi equals 3.14159. Could it be that such physical ratios are really, like pi, mathematical aspects of some underlying logical structure? If so, physicists are not much better off than people who must resort to wrapping a string around a cylinder to determine the value of pi! For theoretical physics thus far sheds hardly a glimmer of light on this question." (D. A. Bromley, et. al., *Physics in Perspective*, Student Edition, Washington, D.C., 1973; National Academy of Sciences/National Research Council Publications, p. 28.)

[14] On the economic requirements of scientific innovation see the author's *Scientific Progress: A Philosophical Essay on the Economies of Research in Natural Science*, Oxford, 1978.

[15] This essay develops and elaborates on some ideas sketched more briefly in Chapter Four, 'The Potential Limitlessness of Science', of the author's book, *The Limits of Science*, Berkeley and Los Angeles, 1985.

NOTES TO ESSAY FIVE

[1] M. S. A. de Condorcet as quoted in Isaac Todhunter, *A History of the Mathematical Theory of Probability*, London, 1865; reprinted New York, 1949, see p. 401. For Condorcet see Gilles-Gaston Granger, *La Mathématique sociale du marquis de Condorcet*, Paris, 1956 and Keith Michael Baker, *Condorcet: From Natural Philosophy to Social Mathematics*, Chicago and London, 1975.

[2] This follows from two laws of probability

(1) $\text{pr}(p) = \text{pr}(p \ \& \ q) + \text{pr}(p \ \& \ \text{not-}q)$.
(2) $\text{pr}(p//q) = \text{pr}(p \ \& \ q) / \text{pr}(q)$.

[3] For realism we might go over to an analogous scheme of three cases: (1) where S "knows what he's talking about", (2) where S is simply talking through his hat and (3) where S has some rough inkling of what is going on. In these three cases S would "get it right" with probability (1), $\text{pr}(p)$, and x where $\text{pr}(p) < x < 1$, respectively. Such a "more realistic" tripartite analysis would complicate the picture without substantially affecting the results at which we shall arrive.

[4] David Hume, *An Enquiry Concerning Human Understanding*, Sect. X, pt. I, attributes this quotation to Plutarch's 'Life of Cato'. But I have not found it there.

[5] J. M. Keynes, *A Treatise on Probability*, London, 1920, p. 181.

[6] The literature is virtually silent on this sort of issue.

[7] Quoted from Don Lyon and Paul Slovik, 'Dominance of Accuracy Information and Neglect of Base Rates in Probability Estimation', *Acta Psychologica*, Vol. 40, 1976, pp. 287–298 (see p. 291).

[8] Daniel Kahneman and Amos Tversky, 'On the Psychology of Prediction', *Research Bulletin No. 12/4* of the Oregon Research Institute, Eugene, 1972. See also Lyon and Slovik, *op. cit.*

[9] P. S. de Laplace, *A Philosophical Essay on Probabilities*, F. W. Truscott and F. L. Emory (eds.), New York, 1951, Chapter 11, pp. 109–125 (see esp. pp. 120–122).

[10] *Ibid.*, pp. 123–124. Compare Fred Wilson, 'The Origins of Hume's Sceptical Argument Against Reason', *History of Philosophy Quarterly*, Vol. 2, 1985, pp. 323–335.

[11] In the sceptical arguments often based on this chain analysis of testimony, it is generally overlooked that *only the first witness* makes a claim about a substantive and potentially problematic fact and that the remaining witnesses report on what is said by someone – which is of an entirely different and presumably more routine matter. Moreover, little attention is paid to the point of Section 5 above – that when independent witnesses attest to the same fact, the resulting overall probability may well exceed the several separate probabilities secured via the individual witnesses.

[12] The relationship at issue was already claimed by the anonymous author (presumably Edmund Halley) of a paper entitled "A Calculation of the Credibility of Human Testimony" which appeared in the *Philosophical Transactions of the Royal Society* for 1699, Vol. 21, pp. 365–389. See F. Wilson, *op. cit.*, p. 328.

NOTES TO ESSAY SEVEN

[1] Picco della Mirandola, *Heptaplus*, 2nd proem, tr. D. Carmichael, New York, 1965, pp. 75–76.

[2] Immanuel Kant, *C.Pu.R.*, A327-8–B383-4.

[3] As Kant sees it, there is a crucial difference between epistemology and ethics in this respect. The former deals with particular concrete objects and is thus confined to the proximate realm where experience can operate. The latter deals with actions at the level of generality and universality, and thus can and must operate on the third level.

NOTE TO ESSAY EIGHT

[1] Testimony of Allan J. McDonald as reported on *The New York Times*, February 26, 1986, p. 16.

NOTES TO ESSAY NINE

[1] J. Birren and K. W. Schaie (eds.), *Handbook of the Psychology of Aging*, New York, 1977.

[2] The number of books on aging is legion. One of the best overall surveys I have encountered is Jan and C. Davis Hendricks, *Aging in a Mass Society*, Cambridge, MA, 1977; 2nd ed. 1981.

[3] Compare Kenneth Boulding's essay, 'The Menace of Methusalah: Possible Consequences of Increased Life Expectancy', in *Collected Papers*, Vol. IV, Boulder, 1974.

[4] But since the division between the humanities and the sciences is itself one that belongs to the humanistic side of the divide as a means for classifying human activities, one would expect, rightly, that it itself also illustrates the very phenomenon under consideration.

NOTES TO ESSAY TEN

[1] Cicero, *De Finibus*, IV, iii, 7.

[2] Compare C. W. Shields, *Philosophia Ultima or Science of the Sciences*, Vol. II, New York, 1889, p. 58.

[3] Francis Bacon, *The Advancement of Learning*, Bk II.

[4] In modern usage, Philosophy is the general term to include Mental Philosophy in all its divisions, still wider application, which placed mental philosophy in contrast with natural philosophy having been generally abandoned. . . . Restricted to the mental sphere. . . . it is a Theory of Knowledge (Epistemology), and concerned with existence as a whole . . . William Fleming's *Vocabulary of Philosophy*, 4th ed., revised by Henry Calderwood, London, 1887, p. 310.

[5] Here and there a few departments of "Philosophy and Psychology" still survive in American colleges and universities. At Harvard the separation led to a battle-royal in the 1920s, which is sketched in Bruce Kuklick, *The Rise of American Philosophy*, New Haven and London, 1977.

[6] Bertrand Russell, *The Problems of Philosophy*, London, 1912, p. 240.

[7] Herbert Spencer, *First Principles*, 6th ed., London, 1862, para. 144.

[8] *The Encyclopedia of Philosophy*, Paul Edwards (ed.), London and New York, 1967.

[9] It is surprising how little historians of philosophy have dealt with this aspect of the development of the subject. There is virtually no trace of concern with it in Lucien Braun's splendid *Histoire de l'histoire de la philosophie*, Paris, 1973.

[10] "Ueber die Frage nach dem Wesen des Philosophie wurde soviel nachgedacht das man geradezu sagen konnte 'Philosophie ist diejenige Forschungsarbeit, die immer nach ihrem eigenen Wesen fragt'". Eberhard Rogge, *Axiomatik alles Moeglichen Philosophierens*, Meisenheim am Glan, 1950.

NOTES TO ESSAY ELEVEN

[1] René Descartes, *Discourse on Method*, Pt. I, tr. E. S. Haldane and G. R. T. Ross.
[2] David Hume, *A Treatise on Human Nature*, Introduction.
[3] Wilhelm Dilthey, *Gesammelte Schriften*, Vol. V, Stuttgart and Goettingen, 1960, p. 134.
[4] Wilhelm Dilthey, *op. cit.*, p. 13. Dilthey remarks that "The anarchy of philosophical systems is one of the most powerful supports from which scepticism draws ever-renewed nourishment. A contradiction arises between the historical realization of their boundless multiplicity and the claims of each to universal validity which supports the sceptical spirit more powerfully than any theoretical argumentation", p. 75.
[5] Moritz Schlick, "The Turning Point in Philosophy" in A. J. Ayer (ed.), *Logical Positivism*, Glencoe, 1959, pp. 53–54. Compare also Kant, *Critique of Pure Reason*, Preface to the First Edition, A viii–x; and Charles Sanders Peirce, "The Fixation of Beliefs," *Collected Papers*, Vol. V, C. Hartshorn and P. Weiss (eds.), Cambridge, MA, 1934, Sect. 5.383.
[6] Benedetto Croce, *History as the Story of Liberty*, tr. by S. Sprigge, Chicago, 1970, pp. 147–48.
[7] 'Russian Writer Says Rockets Cast Doubt on Existence of God', *The New York Times*, Friday, January 23, 1959, p. 3.
[8] This essay is a revision of a paper originally published in Michael Bradie *et al.* (eds.), *The Applied Turn in Contemporary Philosophy*, Bowling Green, 1983, pp. 1–15.

BIBLIOGRAPHY

Almeder, Robert, *The Philosophy of Charles S. Peirce*, Oxford, 1980.
Aquinas, St. Thomas, *Summa Theologica*, New York, 1947.
Barnes, Barry, *Scientific Knowledge and Sociological Theory*, London, 1974.
Barnes, Barry, *Interests and the Growth of Knowledge*, London, 1977.
Bhaskar, Roy, *A Realist Theory of Science*, Atlantic Highlands, 1978.
Bloor, David, *Knowledge and Social Imagery*, London, 1976.
Bohm, David, *Causality and Chance in Modern Physics*, London and New York, 1957.
Bunge, Mario (ed.), *The Critical Approach to Science and Philosophy*, New York, 1964.
Carroll, J. B. (ed.), *Language, Thought, and Reality*, Cambridge, MA, 1956.
Cartwright, Nancy, *How the Laws of Physics Lie*, Oxford, 1984.
Cohen, I. B., *Revolution in Science: The History, Analysis, and Significance of a Concept and a Name*, Cambridge, 1984.
Colodny, R. G. (ed.), *The Nature and Function of Scientific Theories*, Pittsburgh, 1970.
Cushing, James T. *et al.* (eds.), *Science and Reality*, Notre Dame, 1984.
Devitt, Michael, *Realism and Truth*, Princeton, 1984.
Duhem, Pierre, *The Aims and Structure of Physical Theory*, Princeton, 1954.
Dummett, Michael, *Truth and Other Enigmas*, Cambridge, MA, 1978.
Eddington, A. S., *The Nature of the Physical World*, New York, 1928.
Fecher, Vincent Julian, *Error, Deception, and Incomplete Truth*, Rome, 1975.
Feyerabend, Paul, *Against Method*, London, 1975.
Feynman, Richard, *The Character of Physical Law*, Cambridge, MA, 1965.
van Fraassen, Bas, *The Scientific Image*, Oxford, 1980.
Gardner, Martin, *Science: Good, Bad, and Bogus*, New York, 1981.
Glymour, Clark, *Theory and Evidence*, Princeton, 1980.
Goodman, Nelson, *Ways of Worldmaking*, Indianapolis, 1978.
Graubard, Stephen R., and Gerald Holton (eds.), *Excellence and Leadership in a Democracy*, New York, 1962.
Gunderson, Keith (ed.), *Language, Mind, and Knowledge*, Minneapolis, 1975.
Hacking, Ian, *Representing and Intervening*, Cambridge, 1983.
Hanson, N. R., *Patters of Discovery*, Cambridge, 1958.
Harman, Gilbert, *Thought*, Princeton, 1973.
Harré, Rom, *Causal Powers: A Theory of Natural Necessity*, Oxford, 1975.
Hempel, Carl G., *Philosophy of Natural Science*, New Jersey, 1966.
Hesse, Mary, *Revolutions and Reconstructions in the Philosophy of Science*, Bloomington, 1980.
Hesse, Mary, *Models and Analogies in Science*, London, 1963.
Hollis, M. and S. Lukes (eds.), *Rationality and Relativism*, Cambridge, MA, 1982.
Holton, Gerald and Brush, Stephen G., *Introduction to Concepts and Theories in Physical Science*, 2nd ed., Reading, MA, 1973.
Howson, Colin (ed.), *Method and Appraisal in the Physical Sciences*, Cambridge, 1976.
James, William, *Pragmatism*, New York, 1907.

Koerner, Stephen (ed.), *Observation and Interpretation*, New York and London, 1957.
Kuhn, Thomas, *The Structure of Scientific Revolutions*, Chicago, 1970.
Kuhn, Thomas, *The Essential Tension: Selected Studies in Scientific Thought and Change*, Chicago, 1977.
Lakatos, Imre and Musgrave Alan (eds.), *Criticism and the Growth of Knowledge*, Cambridge, 1970.
Laudan, Larry, *Progress and Its Problems*, Berkeley, 1977.
Leplin, Jarrett (ed.), *Scientific Realism*, Berkeley, Los Angeles, London, 1984.
Lewis, C. I., *An Analysis of Knowledge and Valuation*, La Salle, 1962.
Mehra, J. (ed.), *The Physicist's Conception of Nature*, Dordrecht, 1973.
Mertin, R. K., *The Sociology of Science*, Chicago, 1973.
Nagel, Ernest, *The Structure of Science*, New York, 1961.
Nagel, Ernest, P. Suppes, and A. Torshin (eds.), *Logic, Methodology, and Philosophy of Science*, Stanford, 1962.
Newton-Smith, William, *The Rationality of Science*, Boston, 1981.
Peirce, C. S., *The Collected Papers of Charles Sanders Peirce*, Cambridge, MA, 1932.
Popper, Karl R. *The Logic of Discovery*, New York, 1959.
Putnam, Hilary, *Philosophical Papers*, Vol. I, *Mathematics, Matter, and Method*, Cambridge, 1971; Vol. II, *Mind, Language and Reality*, New York, 1975; Vol. III, *Realism and Reason*, New York, 1983.
Putnam, Hilary, *Meaning and the Moral Sciences*, London, 1978.
Putnam, Hilary, *Reason, Truth, and History*, Cambridge, 1981.
Quine, W. V. O., *Word and Object*, New York, 1960.
Rescher, Nicholas, *Conceptual Idealism*, Oxford, 1973.
Rescher, Nicholas, *Empirical Inquiry*, Totowa, 1982.
Rescher, Nicholas, *Induction*, Oxford, 1980.
Rescher, Nicholas, *The Limits of Science*, Berkeley and Los Angeles, 1985.
Rescher, Nicholas and Robert Brandom, *The Logic of Inconsistency*, Oxford, 1980.
Rescher, Nicholas, *Methodological Pragmatism*, Oxford, 1977.
Rescher, Nicholas, *The Riddle of Existence*, Lanham, 1984.
Rescher, Nicholas, *Scientific Progress*, Oxford, 1978.
Rorty, Richard, *Philosophy and the Mirror of Nature*, Princeton, 1979.
Russell, Bertrand, *The Analysis of Matter*, London, 1927.
Russell, Bertrand, *Human Knowledge: Its Scope and Limits*, New York, 1948.
Salmon, Wesley, *Scientific Explanation and the Causal Structure of the World*, Princeton, 1984.
Salmon, Wesley, *Space, Time, and Motion: A Philosophical Introduction*, California, 1975.
Sellars, Wilfrid, *Science and Metaphysics: Variations on Kantian Themes*, London, 1968.
Simon, Herbert A., *The Sciences of the Artificial*, Cambridge, MA, 1969.
Smart, J. J. C., *Between Science and Philosophy*, New York, 1969.
Smart, J. J. C., *Philosophy and Scientific Realism*, London, 1983.
Suppes, Patrick, *A Probabilistic Theory of Causality*, Amsterdam, 1970.
Trigg, Roger, *Reality at Risk*, Brighton, 1986.
Westfall, Richard S., *The Construction of Modern Science: Mechanisms and Mechanics*, New York, 1971.

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